Essays

An Anthology of English Prose

(For B.Sc. Students)

Edited by Dr. Imdad Husain

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(For B.Sc. Students)

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PREFACE

I am grateful to the authorities of the University of the Punjab for inviting me to compile a Book of English Prose for the B.Sc. students. The need for a shorter and differently oriented book seems to have arisen because our science teachers think that literature is redundant for science students and they could also do with less of the English language. I am afraid, I find myself unable to agree with this view. We all know how deplorable already are the standards of English of our graduate students. They need a reasonable amount of English for the pursuit of their advanced scientific studies and the fields, of Govt., industry and others, in which they will be called upon to serve in Pakistan, all require competence in English. We have not switched over to our national languages as media of higher instruction and the work of our Govt., law and industry continues to be done in English. In these circumstances, it seems disastrous to adopt an ambivalent attitude to the study of the English language.

Apart from these utilitarian considerations, the trends of higher scientific education in the rest of the world emphasize not a 'specialist' but a 'generalist' approach. The emphasis is on inter-disciplinary science education. Eminent institutions like the Massachusetts Institute of Technology go so far as to insist upon a sizeable programme of literary and humanistic studies for their science students. Attention in this connection is invited to Sir Richard Livingstone's essay *Specialisation in Education*, included in this selection.

Bearing in mind these considerations, I have made a selection of science-oriented prose, like that of T. H. Huxley, Bertrand Russell, Sir James Jeans, and George Russell Harrison, which discusses some fundamental concepts of science with which our average science student is not acquainted. Then there are a couple of essays on education and the training of character, as well as on the art of writing. It is hoped that these essays will stimulate the students to think about science education in a wider perspective and encourage them to become good human beings and effective citizens, in addition to being scientists.

Some of the dangers of the technological revolution that the world is going through are hinted at in a couple of short stories, which come under the heading of Science Fiction e.g. *The Man in Asbestos : An Allegory of the Future* and *The Pedestrain.* It should be useful for science students to know that while science is necessary and useful, it can prove to be a double-edged weapon. To counteract over-mechanisation and dehumanisation we need some emphasis on humanistic studies.

It is hoped that in teaching these essays and stories the teachers will elaborate the general issues raised.

In the end mine, and the publisher's thanks are due and are hereby tendered to all those who have permitted us to use copyright pieces included in this selection.

Lahore, **Imdad Husain**
November, '71

CONTENTS

CONTENTS

THE METHOD OF SCIENTIFIC INVESTIGATION

Thomas Henry Huxley

The method of scientific investigation is nothlng but the expression of the necessary mode of working of the human mind. It is simply the mode at which all phenomena are reasoned about, rendered precise and exact. There is no more difference, but there is just the same kind of difference, bteween the mental operations of a man of science and those of an ordinary person, as there is beween the operations and methods of a baker or of a butcher weighing out his goods in common scales, and the operations of a chemist in performing a difficult and complex analysis by means of his balance and finely-graduated weights. It is not that the action of the scales in the one case, and the balance in the other, differ in the principles of their construction or manner of working; but the beam of one is set on an infinitely finer axis than the other, and of course turns by the addition of a much smaller weight.

2. You will understand this better, perhaps, if I give you some familiar example. You have all heard it repeated, I dare say, that men of science work by means of induction and deduction, and that by the help of these operations, they, in a sort of sense, wring from Nature certain other things, which are called natural laws, and causes, and that out of these, by some cunning skill of their own, they build up hypotheses and theories. And it is imagined by many, that the operations of the common mind can by no means by compared with these processes, and that they have to be acquired by a sort of special apprenticeship to the craft. To hear all these large words, you would think that the mind of a man of science must be constituted differently from that of his fellow men ; but if you will not be frightened by terms, you will discover that you are quite wrong, and that all these terrible apparatus are being used by yourselves every day and every hour of your lives.

3. There is a well known incident in one of Moliere's plays, where the author makes the hero express unbounded delight on be-

ing told that he had been talking prose during the whole of his life. In the same way, I trust, that you will take comfort, and be delighted with yourselves, on the discovery that you have been acting on the principles of inductive and deductive philosophy during the same period. Probably there is not one here who has not in the course of the day had occasion to set in motion a complex train of reasoning, of the very same kind, though differing of course in degree, as that which a scientific man goes through in tracing the causes of natural phenomena.

4. A very trivial circumstance will serve to exemplify this. Suppose you go into a fruiterer's shop, wanting an apple,—you take up one, and, on biting it, you find it sour ; you look at it, and see that it is hard and green. You take up another one, and that too is hard, green, and sour. The shopman offers you a third ; but, before biting it, you examine it, and find that it is hard and green, and you immediately say that you will not have it, as it must be sour, like those that you have already tried.

5. Nothing can be more simple than

that, you think ; but if you will take the trouble to analyse and trace out into its logical elements what has been done by the mind, you will be greatly surprised. In the first place, you have performed the operation of induction. You found that, in two experiences, hardness and greenness in apples went together with sourness. It was so in the first case, and it was confirmed by the second. True, it is a very small basis, but still it is enough to make an induction from ; you generalise the facts, and you expect to find sourness in apples where you get hardness and greenness. You found upon that a general law, that all hard and green apples are sour ; and that, so far as it goes, is a perfect induction. Well, having got your natural law in this way, when you are offered another apple which you find is hard and green, you say, "All hard and green apples are sour ; this apple is hard and green, therefore this apple is sour." That train of reasoning is what logicians call a syllogism, and has all its various parts and terms,—its major premiss, its minor premiss, and its conclusion. And, by the help of further reasoning, which, if

drawn out, would have to be exhibited in two or three other syllogisms, you arrive at your final determination. "I will not have that apple." So that, you see, you have, in the first place, established a law by induction, and upon that you have founded a deduction, and reasoned out the special conclusion of the particular case. Well now, suppose, having got your law, that at some time afterwards, you are discussing the qualities of apples with a friend: you will say to him, "It is a very curious thing, but I find that all hard and green apples are sour!" Your friend says to you, "But how do you know that?" You at once reply, "Oh, because I have tried them over and over again, and have always found them to be so." Well, if we were talking science instead of common sens , we should call that an experimental verification. And, if still opposed, you go further, and say, "I have heard from the people in Somersetshire and Devonshire, where a large number of apples are grown, that they have observed the same thing. It is also found to be the case in Normandy, and in North America. In short, I find it to be the

universal experience of mankind wherever attention has been directed to the subject." Whereupon, your friend, unless he is a very unreasonable man, agrees with you, and is convinced that you are quite right in the conclusion you have drawn. He believes, although perhaps he does not know he believes it, that the more extensive verifications are,—that the more frequently experiments have been made, and results of the same kind arrived at,—that the more varied the conditions under which the same results are attained, the more certain is the ultimate conclusion, and he disputes the question no further. He sees that the experiment has been tried under all sorts of conditions, as to time, place, and people, with the same result; and he says with you, therefore, that the law you have laid down must be a good one, and he must believe it.

6. In science we do the same thing:—the philosopher exercises precisely the same faculties, though in a much more delicate manner. In scientific inquiry it becomes a matter of duty to expose a supposed law to every possible kind of verification, and to take care, moreover, that this is done

intentionally, and not left to a mere accident, as in the case of the apples. And in science, as in common life, our confidence in a law is in exact proportion to the absence of vairation in the result of our experimental verifications. For instance, if you let go your grasp of an article you may have in your hand, it will immediately fall to the ground. This is a very common verification of one of the best established laws of nature—that of gravitation. The method by which men of science establish the existence of that law is exactly the same as that by which we have established the trivial proposition about the sourness of hard and green apples. But we believe it in such an extensive, thorough, and unhesitating manner because the universal experience of mankind verifies it, and we can verify it ourselves at any time; and that is the strongest possible foundation on which any natural law can rest.

7. So much, then by way of proof. The method of establishing laws in science is exactly the same as that pursued in common life. Let us now turn to another matter (though really it is but another

phase of the same question), and that is, the method by which, from the relations of certain phenomena, we prove that some stand in the position of causes towards the others.

8. I want to put the case clearly before you, and I will therefore show you what I mean by another familiar example. I will suppose that one of you, on coming down in the morning to the parlour of your house, finds that a tea-pot and some spoons which has been left in the room on the previous evening are gone,—the window is open, and you observe the mark of a dirty hand on the window-frame, and perhaps, in addition to that, you notice the impress of a hob-nailed shoe on the gravel outside. All these phenomena have struck your attention instantly, and before two seconds have passed you say, "Oh, somebody has broken open the window, entered the room and run off with the spoons and the tea-pot!" That speech is out of your mouth in a moment. And you will probably add, "I know there has; I am quite sure of it!" You mean to say exactly what you know; but in reality you are giving expression to

what is, in all essential particulars, an hypothesis. You do not know it at all; it is nothing but an hypothesis rapidly framed in your own mind. And it is an hypothesis founded on a long train of inductions and deductions.

9. What are those inductions and deductions, and how have you got at this hypothesis? You have observed, in the first place, that the window is open; but by a train of reasoning involving many inductions and deductions, you have probably arrived long before at the general law—and a very good one it is—that windows do not open of themselves; and you therefore conclude that something has opened the window. A second general law that you have arrived at in the same way is that tea-pots and spoons do not go out of a window spontaneously, and you are satisfied that as they are not now where you left them they have been removed. In the third place, you look at the marks on the window-sill, and the shoe-mark outside, and you say that in all previous experience the former kind of mark has never been produced by anything else but the hand of a human be-

ing; and the same experience shows that no other animal but man at present wears shoes with hob-nails in them such as would produce the marks in the gravel. I do not know, even if we could discover any of those "missing links" that are talked about, that they would help us to any other conclusion! At any rate the law which states our present experience is strong enough for my present purpose. You next reach the conclusion, that as these kinds of marks have not been left by any other animals than men, or are liable to be formed in any other way than by a man's hand and shoe, the marks in question have been formed by a man in that way. You have, further, a general law, founded on observation and experience, and that, too, is, I am sorry to say, a very universal and unimpeachable one,—that some men are thieves, and you assume at once from all these premisses—and that is what constitutes your hypothesis—that the man who made the marks outside and on the window-sill, opened the window, got into the room, and stole your tea-pot and spoons. You have now arrived at a *vera causa* :— you have assumed a cause

which, it is plain, is competent to produce all the phenomena you have observed. You can explain all these phenomena only by the hypothesis of a thief. But that is a hypothetical conclusion, of the justice of which you have no absolute proof at all; it is only rendered highly probable by a series of inductive and deductive reasonings.

10. I suppose your first action, assuming that you are a man of ordinary common sense, and that you have established this hypothesis to your own satisfaction, will very likely be to go off for the police, and set them on the track of the burglar, with the view to the recovery of our property. But just as you are starting with this object, some person comes in, and on learning what you are about, says, "My good friend, you are going on a great deal too fast. How do you know that the man who really made the marks took the spoons? It might have been a monkey that took them, and man may have merely looked in afterwards." You would probably reply, "Well, that is all very well, but you see it is contrary to all experience of the way tea-pots

and spoons are abstracted ; so that, at any rate, your hypothesis is less probable than mine." While you are talking the thing over in this way, another friend arrives, one of that good kind of people that I was talking of a little while ago. And he might say, "Oh, my dear sir, you are certainly going on a great deal too fast. You are most presumptuous. You admit that all these occurrences took place when you were fast asleep, at a time when you could not possibly have known anything about what was taking place. How do you know that the laws of Nature are not suspended during the night ? It may be that there has been some kind of supernatural interference in this case." In point of fact, he declares that your hypothesis is one of which you cannot at all demonstrate the truth, and that you are by no means sure that the law of Nature are the same when you are asleep as when you are awake.

11. Well, now, you cannot at the moment answer that kind of reasoning. You feel that your worthy friend has you somewhat at a disadvantage. You will feel perfectly convinced in your own mind however, that

you are quite right, and you say to him, "My good friend, I can only be guided by the natrual probabilities of the case and if you will be kind enough to stand aside and permit me to pass, I will go and fetch the police." Well, we will suppose that your journey is successful, and that by good luck you meet with a policeman; that eventually the burglar is found with your property on his person, and the marks correspond to his boots. Probably any jury would consider those facts a very good experimental verification of your hypothesis, touching the cause of the abnormal phenomena observed in your parlour, and would act accordingly.

12. Now, in this suppositious case, I have taken phenomena of a very common kind, in order that you might see what are the different steps in an ordinary process of reasoning, if you will only take the trouble to analyse it carefully. All the operations have described you will see are involved in the mind of any man of sense in leading him to a conclusion as to the course he should take in order to make good a robbery and punish the offender. I say that you

are led in that case, to your conclusion by exactly the same train of reasoning as that which a man of science pursues when he is endeavouring to discover the origin and laws of the most occult phenomena. The process is, and always must be, the same and precisely the same mode of reasoning was employed by Newton and Laplace in their endeavours to discover and define the causes of the movements of the heavenly bodies, as you, with your own common sense, would employ to detect a burglar. The only difference is that the nature of the inquiry being more abstruse every step has to be most carefully watched so that there may not be a single crack or flaw in your hypothesis. A flaw or crack in many of the hypothesis of daily life may be of little or no moment as affecting the general correctness of the conclusions at which we may arrive ; but, in a scientific inquiry, a fallacy, great or small, is always of importance, and is sure to be in the long run constantly productive of mischievous, if not fatal results.

13. Do not allow yourselves to be misled by the common notion that an hypothesis

is untrustworthy simply because it is an hypothesis. It is often urged, in respect to some scientific conclusion, that, after all, it is only an hypothesis. But what more have we to guide us in nine-tenths of the most important affairs of daily life then hypotheses, and often very ill based ones? So that in science, where the evidence of an hypothesis is subjected to the most rigid examination, we may rightly pursue the same course. You may have hypotheses and hypotheses. A man may say, if he likes, that the moon is made of green cheese: that is an hypothesis. But another man, who has devoted a great deal of time and attention to the subject, and availed himself of the most powerful telescopes and the results of the observations of others, declares that in his opinion it is probably composed of materials very similar to those of which our own earth is made up: and that is also only an hypothesis. But I need not tell you that there is an enormous difference in the value of the two hypotheses. That one which is based on sound scientific knowledge is sure to have a corresponding value; and that which is a

mere hasty random guess is likely to have but little value. Every great step in our progress in discovering causes has been made in exactly the same way as that whch I have detailed to you. A person observing the occurrence of certain facts and phenomena asks, naturally enough, what process, what kind of operation known to occur in Nature applied to the particular case, will unravel and explain the mystery? Hence you have the scientific hypothesis; and its value will be proportionate to the care and completeness with which its basis had been tested and verified. It is in these matters as in the commonest affairs of practical life the guess of the fool will be folly, while the guess of the wise man will contain wisdom. In all cases, you see that the value of the result depends on the patience and faithfulness with which the investigator applies to his hypothesis every possible kind of verification.

GALILEO AND SCIENTIFIC METHOD

Bertrand Russell

Scientific method although in its more refined form it may seem complicated, is in essence remarkably simple. It consists in observing such facts as will enable the observer to discover general laws governing facts of the kind in question. The two stages first of observation and second of inference to a law are both essential and each is susceptible of almost indefinite refinement but in essence the first man who said 'fire burns' was employing scientific method at any rate if he had allowed himself to be burnt several times. This man had already passed through the two stages of observation and generalization. He had not; however, what scientific technique demands—a careful choice of significant facts on the one hard and on the other hand various means of arriving at laws otherwise than by mere generalization. The man who says' unsupported bodies in air fall' has merely generalized, and is liable to be refuted by balloons, butterflies and aero-

planes; whereas the man who understands the theory of falling bodies knows also why certain exceptional bodies do not fall.

Scientific method, simple as it is in essence, has been acquired only with great difficulty, and is still employed only by a minority, who themselves confine its employment to a minority of the questions upon which they have opinions. If you number among your acquaintances some eminent man of science, accustomed to the minutest quantitative precision in his experiments and the most abstruse skill in his inference from them, you will be able to make him the subject of a little experiment which is likely to be by no means unilluminating. If you tackle him on party politics, theology, income-tax, house-agents, the bumptiousness of the working-classes, and other topics of a like nature, you are pretty sure, before long, to provoke an explosion and to bear him expressing wholly untested opinions with a dogmatism which he would never display in regard to the well-founded results of his laboratory experiments.

As this illustration shows, the scientific attitude is in some degree unnatural to man; the majority of our opinions are wishfulfilments, like dreams in the Freudian theory.

The mind of the most rational among us may be compared to a stormy ocean of passionate convictions based upon desire upon which float perilously a few tiny boats carrying a cargo of scientifically tested beliefs. Nor is this to be altogether deplored: life has to be lived, and there is no time to test rationally all the beliefs by which our conduct is regulated. Without a certain wholesome rashness, no one could long survive. Scientific method, therefore must, in its very nature be confined to the more solemn and official of our opinions. A medical man who gives advice on diet should give it after full consideration of all that science has to say on the matter, but the man who follows his advice cannot stop to verify it, and is obliged to rely, therefore, not upon science, but upon his belief that his medical adviser is scientific. A community impregnated with science is one in which the recognized experts have arrived at their opinions by scientific methods, but it is impossible for the ordinary citizen to repeat the work of the experts for himself. There is, in the modern world, a great body of well-attested knowledge on all kinds of subjects, which the ordinary man accepts on authority without any need for hesita-

tion : but as soon as any strong passion intervenes to warp the expert's judgment he becomes unreliable whatever scientific equipment he may possess. The views of medical men on pregnancy, child-birth, and lactation were until fairly recently impregnated with sadism. It required for example, more evidence to persuade them that anaesthetics may be used in child-birth than it would have required to persuade them of the opposite. Anyone who desires an hour's amusement may be advised to look up the tergiversations of eminent craniologists in their attempts to prove from brain measurements that 'women are stupider than men.'

It is not, however, the lapses of scientific men that concern us when we are trying to describe scientific method. A scientific opinion is one for which there is some reason to believe true ; as unscientific opinion is one which is held for same reason other than its probable truth. Our age is distinguished from all ages before the seventeenth century by the fact that some of our opinions are scientific in the above sense. I accept bare matters of fact, since generality in a greater or less degree is an

1. See Havelock Bills, *Man and Women* on edition pp. 199 V.

essential characteristic of science, and since men (with the exception of a few mystics) have never been able wholly to deny the obvious facts of their everyday existence.

The Greeks, eminent as they were in almost every department of human activity, did surprisingly little for the creation of science. The great intellectual achievement of the Greeks was geometry, which they believed to be an *a priori* study proceeding from self-evident premises, and not requiring experimental verification. The Greek genius was deductive rather than inductive: and was therefore at home in mathematics. In the ages that followed, Greek mathematics were nearly forgotten, while other products of the Greek passion for deduction survived and flourished, notably theology and law. The Greeks observed the world as poets rather than as men of science, partly, I think, because all manual activity was ungentlemanly, so that any study which required experiment seemed a little vulgar. Perhaps it would be fanciful to connect with this prejudice the fact that the department in which the Greeks were most scientific was astronomy, which deals with bodies that only can be seen and not touched.

However that may be, it is certainly re-

markable how much the Greeks discovered in astronomy. They early decided that the earth is round, and some of them arrived at the Copernican theory that it is the earth's rotation, and not the revolution of the heavens, that causes the apparent diurnal motion of the sun and stars. Archimedes, writing to King Gelon of Syracuse, says: 'Aristarchus of Samos brought out a book consisting of some hypotheses of which the premises lead to the conclusion that the universe is many times greater than that now so called. His hypotheses are that the fixed stars and the sun remain unmoved, that the earth revolves about the sun in the circumference of a circle, the sun lying in the centre of the orbit.' Thus the Greeks discovered not only the diurnal rotation of the earth, but also its annual revolution about the sun. It was the discovery that a Greek had held this opinion which gave Copernicus courage to revive it. In the days of the Renaissance, when Copernicus lived, it was held that any opinion which had been entertained by an ancient might be true, but an opinion which no ancient had entertained could not deserve respect. I doubt whether Copernicus would ever have become a Copernican but for Aristar-

chus hose opinion had been forgotten until th revival of clascal learning.

The Geeks also dovered perfectly valid methods of measing the circumference of the earth. atosthenes the Geographer stimated it a 250,000 stadia (about 24,662 miles), which by no means far from the truth.

The most scientific of the reeks was Archimedes (257-212 B.C.). L Leonardo da Vinci in a later period, he re mended himself to a prince on the gro of his skill in the arts of war, and like ardo he was granted permission to add t knowledge on condition that he su man from human life. His activities in t ed pect were, however, more distingu than those of Leonardo, since he inve the most amazing mechanical contrivan for defending the city of Syracuse agai the Romans, and was finally killed by Roman soldier when that city was captured. He is said to have been so absorbed in a mathematical problem that he did not notice the Romans coming. Plutarch is very apologetic on the subject of the mechanical inventions of Archimedes, which he feels, to have been hardly worthy of a gentleman; but he considers him excusable on the

ground that he was helping his cousin the king at a time of dire peril.

Archimedes showed great genius in mathematics and extraordinary skill in the invention of mechanical contrivances, but his contributions to science, remarkable as they are, still display the deductive attitude of the Greeks, which made the experimental method scarcely possible for them. His work on Statics is famous, and justly so, but it proceeds from axioms like Euclid's geometry, and the axioms are supposed to be self-evident, not the result of experiment. His book *On Floating Bodies* is the one which according to tradition resulted from the problem of King Hiero's crown, which was suspected of being not made of pure gold. This problem, as everyone knows, Archimedes is supposed to have solved while in his bath. At any rate, the method which he proposes in his book for such cases is a perfectly valid one, and although the book proceeds from postulates by a method of deduction, one cannot but suppose that he arrived at the postulates experimentally. This is, perhaps, the most nearly scientific (in the modern sense) of the works of Archimedes. Soon after his time, however, such feeling as the Greeks had had for the

scientific investigation of natural phenomena decayed, and though pure methematics continued to flourish down to the capture of Alexandria by the Mohammadans, there were hardly any further advances in natural science, and the best that had been done, such as the theory of Aristarchus, was forgotten.

The Arabs were more experimental than the Greeks, especially in chemistry. They hoped to transmute base metals into gold, to discover the philosopher's stone, and to concoct the elixir of life. Partly on this account chemical investigations were viewed with favour. Throughout the Dark Ages it was mainly by the Arabs that the tradition of civilization was carried on, and it was largely from them that Christians such as Rogar Bacon acquired whatever scientific knowledge the later Middle Ages possessed. The Arabs, however, had a defect which was the opposite of that of the Greeks: they sought detached fact rather than general principles, and had not the power of inferring general laws from the facts which they discovered.

In Europe, when the scholastic system first began to give way before the Renaissance, there came to be for a time, a dis-

like of all generalizations and all systems. Montaigne illustrates this tendency. He likes queer facts, particularly if they disprove something. He has no desire to make his opinions systematic and coherent. Rebelais also, with his motto: '*Fars ce que voudras,*" is as averse from intellectual as from other fetters. The Renaissance rejoiced in the recovered liberty of speculation, and was not anxious to lose this liberty even in the interest of truth. Of the typical figures of the Renaissance by far the most scientific was Leonardo, whose note-books are fascinating and contain many brilliant anticipations of later discoveries, but he brought almost nothing to fruition, and remained without effect upon his scientific successors.

Scientific method, as we understand it, comes into the world full-fledged with Galileo (1564-1642), and to a somewhat lesser degree in his contemporary, Kepler (1571-1633). Kepler is known to fame through his three laws; he first discovered that the planets move round the sun in circles. To the modern mind there is nothing astonishing in the fact that the earth's orbit is an ellipse, but to minds trained on antiquity anything except a circle, or some complication of circles, seemed almost in-

credible for a heavenly body. To the Greeks the planets were divine, and must therefore move in perfect curves. Circles and epicycles did not offend their aesthetic susceptibilities, but a crooked, skew orbit such as the earth's actually is would have shocked them deeply. Uuprejudiced observation without regard to aesthetic prejudices required therefore, at that time, a rare intensity of scientific ardour. It was Kepler and Galileo who established the fact that the earth and the other planets go round the sun. This had been asserted by Copernicus, and, as we have seen by certain Greeks, but they had not succeeded in giving proofs. Copernicus, indeed, had no serious arguments to advance in favour of his view, It would be doing Kepler more than justice to suggest that in adopting the Copernican hypothesis he was acting on purely scientific motives. It appears that, at any rate in youth, he was addicted to sun worship, and thought the centre of the universe the only place worthy of so great a deity. None but scientific motive, however, could have led him to the discovery that the planetry orbits are ellipses and not circles.

He, and still more Galileo, possessed the scientific method in its completeness. While

much more is known now than was known in their days, nothing essential has been added to method. They proceeded from observation of particular facts to the establishment of exact quantitative laws, by means of which future particular fact could be perdicted. They shocked their contemporaries profoundly, partly because their conclusions were inherently shocking to the beliefs of that age, but partly also because the belief in authority had enabled learned men to confine their researches to libraries, and the professors were pained at the suggestion that it might be necessary to look at the world in order to know what it is like.

Galileo, it must be confessed, was something of a *gamin*. When still very young he became Professor of Mathematics at Pisa, but as the salary was only 7½d, he does not seem to have thought that a very dignified bearing could be expected of him. He began by writing a treatise against the wearing of cap and gown in the University, which may perhaps have been popular with undergraduates, but was viewed with grave disfavour by his fellow-professors. He would amuse himself by arranging occasions which would make his colleagues look silly. They asserted, for example, on the basis of

Aristotle's Physics, that a body weighing ten pounds would fall through a given distance in one-tenth of the time that would be taken by a body weighing one pound. So he went up to the top of the Leaning Tower of Pisa one morning with a ten-pound shot and a one-pound shot, and just as the professors were proceeding with leisurely dignity to their respective lecture-rooms in the presence of their pupils, he attracted their attention and dropped the two weights from the top of the tower to their feet. The two weights arrived practically simultaneously. The professors, however, maintained that their eyes must have deceived them, since it was impossible that Aristotle could be in error.

On another occasion he was even rash. Giovanni dei Medici, who was the Governor of Leghorn, invented a dredging machine of which he was very proud. Galileo pointed out that whatever else it might do it would not dredge, which proved to be a fact. This caused Giovanni to become an ardent Aristotlian.

Galileo became unpopular and was hissed at his lectures—a fate which has at times aslo befallen Einstein in Berlin. Then he made a telescope and invited the professors

to look through it at Jupiter's moons. They refused on the ground that Aristotle had not mentioned these satellites, and therefore anybody who thought he saw them must be mistaken.

The experiment from the Leaning Tower of Pisa illustrated Galileo's first important piece of work, namely, the establishment of the Law of Falling Bodies, according to which all bodies fall at the same rate in a vacuum and at the end of a given time have a velocity proportional to the time in which they have been falling, and have traversed a distance proportional to the square of that time-Aristotle had maintained otherwise, but neither he nor any of his successors throughout nearly two thousand years had taken the trouble to find out whether what he said was true. The idea of doing so was a novelty, and Galileo's disrespect for authority was considered abominable. He had, of course, many friends, men to whom the spectacle of intelligence was delightful in itself. Few such men, however, held academic posts, and university opinion was bitterly hostile to his discoveries.

As everyone knows, he came in conflict with the Inquisition at the end of his life for maintaining that the earth goes round

the sun. He had a previous minor encounter from which he had emerged without great damage, but in the year 1632 he published a book of dialogues on the Copernican and Ptolemaic system, in which he had the temerity to place some remarks that had been made by the Pope into the mouth of a character named Pimplicius. The Pope had hitherto been friendly to him, but at this point became furious. Galileo was living at Florence on terms of friendship with the Grand Duke, but the Inquisition sent for him to come to Rome to be tried and threatened the Grand Duke with pains and penalties if he continued to shelter Galileo. Galileo was at this time seventy years old, very ill, and going blind; he sent a medical certficate to the affect that he was not fit to travel, so the Inquisition sent a doctor of their own with orders that as soon as he was well enough he should be brought in chains. Upon hearing that this order was on its way, he set out voluntarily. By means of threats he was induced to make submission.

It is not ture that, after reciting this abjuration, he muttered '*Eppur is Muove*.' It was the world that said this—not Galileo. The Inquisition stated that Galileo's fate

should be 'a warning to others to abstain from delinquencies of this sort.' In this they were successful, so far, at least, as Italy was concerned. Galileo was the last of the great Italians. No Italian since his day has been capable of delinquencies of this sort. It cannot be said that the Church has altered greatly since the time of Galileo. Wherever it has power, as in Ireland and Boston, it still forbids all literature containing new ideas.

The conflict between Galileo and the Inquisition is not merely the conflict between free thought and bigotry or between science and religion : it is a conflict between the spirit of induction and the spirit of deduction. Those who believe in deduction as the method of arriving at knowledge are compelled to find their premises somewhere, usually in a sacred book. Deduction from inspired books is the method of arriving at truth employed by jurists, Christians.... and Communists. Since deduction as a means of obtaining knowledge collapses when doubt is thrown upon its premises, those who believe in deducton must necessarily be bitter against men who question the authority of the sacred book. Galileo questioned both Aristotle and the Scriptures,

and thereby destroyed the whole edifice of medieval knowledge. His predecesssors had known how the world was created, what was man's destiny, the deepest mysteries of metaphysics, and the hidden principles governing the behaviour of bodies. Throughout the moral and material universe nothing was mysterious to them, nothing hidden, nothing incapable of exposition in orderly syllogisms. Compared with all this wealth, what was left to the foollowers of Galileo ?—a law of falling bodies, the theory of the pendulum, and Kepler's ellipses. Can it be wondered at that the learned cried out at such a destruction of their hard-won wealth ? As the rising sun scatters the multitude of stars, so Galileo's few proved truths banished the scintillating firmament of medieval certainties.

Socrates had said that he was wiser then his contemporaries because he alone knew that he knew nothing. This was a rhetorical device. Galileo could have said with truth that he knew something ; but knew he knew little, while his Aristotelian contemporaries knew nothing, but thought they knew much. Knowledge, as opposed to

fantasies of wish-fulfilment, is difficult to come by. A little contact with real knowledge makes fantasies less acceptable. As a matter of fact, knowledge is even harder to come by then Galileo supposed and much that he believed was only approximate, but in the process of acquiring knowledge at once secure and general, Galileo took the first great step. He is, therefore, the father of modern times. Whatever we may like or dislike about the age in which we live, its increase of population, its improvement in health, its trains, motor-cars, radio, politics, and advertisements of soap—all emanate from Galileo. If the Inquisition could have caught him young, we might not now be enjoying the blessings of air-warfare and poisoned gas, nor, on the other hand, the diminution of poverty and disease which is characteristic of our age.

It is customary amongst a certain school of sociologists to mixinize the importance of intelligence, and to attribute all great events to large impersonal causes. I believe this to be an entire delusion. I believe that if a hundred of the men of the seventeenth century had been killed in infancy, the modern world would not exist. And of these hundred, Galileo is the chief.

THE SCIENTIST AS AN ARTIST

George Russell Harrison

The image of the scientist held today in the minds of non-scientists is likely to be unduly conditioned by the impact of technology on modern life. Technology is easily confused with science, to which it is related in somewhat the same way that journalism is related to poetry. As a result the scientist and the artist are often considered to be almost diametrically opposed in their methods of operation, the artist basing his activities primarily on emotion tempered by reason, and the scientist his on reason not tempered by anything. In deed, science is supposed by many to carry out its operations so implacably under the dictates of blind logic that it is likely to over-reach itself, and to land man in situations which are very disturbing to the humanist.

Typical of a common misunderstanding regarding the forces that drive the scientist is a statement which Boris Pasternak has

Dr. Zhivago make in his diary : "Progress in science is governed by the laws of repulsion, every step forward is made by the refutation of prevalent errors and false theories....Forward steps in art are governed by the laws of attraction, are the result of the imitation of and the admiration for their beloved predecessors."

I have found no scientist who agrees with this statement ; all urge insistently that science progresses, not by negation of what has gone before, but by attractions and imitations similar to those which stimulate progress in art. It was Sir Isaac Newton himself who said, "If I have seen further it is by standing on the shoulders of giants."

The work of the true scientist is primarily directed and conditioned by aesthetic values. Advances in science result, not from purely national considerations, but from the search for beauty, the seeking out of order, harmony, symmetry, and balance. No scientist could ever, with aesthetic guides, thread his way through the impenetrable thicket of all the possible deductions that result from a purely logical approach. Inspiration comes to the mind when apparently random fancies, welling up from the unconscious, are seen to fit into previously

unperceived patterns. The creative imagination that invokes and evaluates such patterns is the major tool of artist and scientist alike.

Every scientific hypothesis or discovery is a work of art. It arouses in observers feelings of beauty to the degree that it appeals as true, and feelings of interest to the degree that it is new, disciplined, and fitting. The panorama of modern science is like a vast mural painting on which thousands of artists have been filling in detail over the centuries, a hypothesis and its subsequent verification here, a discovery and its explanation there. At times it can be seen that certain areas of the mural need workiug over, to bring out a previously unperceived degree of order, or to smooth together sections in which overlapping detail does not match. Seldom must an area of the mural be blanked out completely. When this happens the scientist painters have many traces to guide them, and never need start again at the very beginning.

The greater a scientific hypothesis the more closely do the drives responsible for it resemble those which produce a great work of art. Einstein himself described his

first tentative probings in the direction of relativity as being guided by the need for symmetry and order. He might have been describing the approach of Beethoven, or Praxiteles, or Milton, to the working out of their respective inspirations.

Like a work of art, a scientific generalization needs technical understanding for its appreciation. My colleague in the School of Architecture and I stand mute before an abstractionist painting, he drinking it in, I feeling inadequate before what seem to be the scratchings of an adolescent. Later we stand together before a plaque setting forth Maxwell's equations and are mute again; but now it is my turn to be stimulated, and to have imagination expanded, I am filled with wonder that in less space than is needed for the first two of the Ten Commandments, themselves no mean concentration of experience, is compressed the behaviour of all the electric charges and magnetic fields that man has ever met, whether in the nucleus of an atom, a beam of light, an electric motor, or a cosmic ray from a distant nebula.

The same concentration of information that one finds in the picture better than 10,000 words, or the poetic turn that

stimulates a hundred echoes in the mind, is found in science in such equation as Einstein's "E--mc." The vast vitals of truth thus bundled in a tiny package can be bulked out in the mind of the beholder in accordance with his understanding. The very process of so-bulking them out will, indeed, increase his powers of comprehension.

As Sir Edward Appleton has said, "So far from reducing life to something cold and mechanical, modern science.......like poetry reveals depths and mysteries beyond and quite different from the ordinary matter-of-fact world to which we are accustomed."

The scientist feels that he has achieved one of his goals when he has "explained" something. By this he means that he has viewed a phenomenon from all sides, and has seen that it fits comfortably into the mural that relates other "explained" phenomena. "Explanation," involving as it does the process of "laying out flat," seem to me to have been originally an artistic term. The scientist lays things out flat for the same reasons the artist does, so he can see them, perceive their relationships and if necessary rearrange them.

It is sometimes said that our picture of

the atom is growing more and more vague. This is by no means the case, the atom itself looks more blurry, to be sure, but this turns out to be the nature of atoms, the picture grows clearer and more definite. We remember more frequently than before that we are looking at pictures of atoms, not at atoms themselves. Recognizing the difference between an atom and its picture increases our ability to specify how atoms will behave in various circumstances. As we mature in aesthetic appreciation our need diminishes for pictures of atoms which resemble so closely the things that we see in the every day world.

Like earlier men with their gods, we are able to visualize the unknown only in terms of the known. So the scientist has come to recognize that his molecules and neutrons and nuclei are artistic products of his creative imagination. They cannot look like the real things, which is unseeable, but the pictures have validity in the degree that they enable him to predict molecular or nuclear happenings correctly.

The sweeping beam that paints the picture on a television tube is a stream of electrons impinging on a fluorescent screen. These electrons have been seen by no one, but are

found to behave like tiny blobs of electricity which can be weighed and measured by appropriately delicate means. So the artist-scientist paints them in these terms on the mural and sees that they are parts of atoms, emit radiation, and can be expected to perform various other electronic tricks. But the picture distorts if pushed too far, and the electron model is found unable to explain some newly observed facts. Then a quick repainting job is done; the electron in the mural is set to spinning, and is hastily dressed up with waves to guide it.

When the atom was found by Rutherford to contain electrons it was natural to think at once of the analogy with planets in the solar system. How pleasant to visulize in the microcosm 1,000,000,000 suns, each with planets circling about in tiny majesty! Bode had painted a detail of great beauty on the mural by showing that the distances of the nearer planets from the sun bear a simple mathematical relationship to one another, and had by this means even located a missing planet where the asteroids were later found. Kepler discovered that a planet swreps out in its orbit equal areas in equal times, no matter whether it is falling toward the sun or climbing from it. How

exciting to imagine this harmonious music of the spheres transferred to the inner reaches of the atom. What a beautiful example of order if in the microcosm one should find the same stark mathematical beauty as in the cosmos !

Locking at neighbouring areas of the mural soon showed that this picture could not be exact. If it were true the atom would quickly collapse in a tiny flash of light as its electrons spiraled hurriedly into their nuclear sun. Many scientists were downcast at this failure of the universe to obey their visualizations. Then in 1913 Niels Bohr, working backward from the existence of line in the spectrum, and using two radical new assumptions analogous to some found useful for other purposes, was able to calculate the wave length of the oberved lines accurately to one part in 100,000. He showed that what was needed to understand the atom, at least as an emitter of radiation, was to relax a bit, deliberately suppose that everyone had been misled by the paintings of the hydrogen atom in other parts of the mural, and conclude that an electron can stay put in an orbit indefinitely, radiating no light unless it jumps to another orbit.

The point for us is that the new laws thus found to govern the motion of electrons in atoms, proved incredibly more beautiful and stimulating. And as a result, widely separated parts of the mural, previously out of kilter at the edges, could be fitted into a remarkable new unity when repainted in terms of these new assumptions.

Then came the great perception that the 90 odd kinds of chemical elements that exist on earth are not 90 different entities, but are merely differing assemblies of three basic particles, neutrons, protons, and electrons, in various numbers of patterns. Tin is tin and oxygen is oxygen, not because they were spilled out of different bags at the Creation, but because tin comes into being when electrons are sent circling around a nucleus having 50 positive charges and oxygen when there are only eight.

Thus, through the work of a host of artistic scientist, the great explanation dawned of why there is a Periodic Table of the chemical elements, and why each atom has its individual properties. Soon it became possible even to achieve some mastery over the transmutation of atom. As the world has learned to its present discomfort, but will l[illegible] to learn to its great advantage, the

new model of the atom works. It is a dynamic model, and will continue to grow in definiteness. From time to time new details will have to be painted in and some of the present ones will need revision. This will be because atoms will be subjected to new probings and investigations.

The aesthetic triumph of explaining all molecules as simple assemblies of atoms, and all atoms as arrangements of three basic types of particles, fills any new scientist with stirrings similar to those which overwhelm a young sculptor on first beholding the head of Nefertiti, or the Victory of Samothrace.

Like art, science has a periodic need to burst the bonds of the classical. To get the greatest aesthetic pleasure from contemplation of any sort of imaginative creation requires some degree of novelty. I can remember when it was exciting to a motion-picture audience just to watch the opening of a door. As Western architecture has moved from the romanesque to the gothic, to the baroque, to the modern, as painting has passed through its classical and romantic and impressionistic and abstractionist periods, so has science periodically made great shifts in emphasis.

After people had become accustomed to the fact that a two-dimensional painting could capture so much of the reality of the three-dimensional world, it was necessary to find new ways of looking at things. Gesture was added to give the illusion of movement. When Leonardo da Vinci began his work, perspective in painting was new. Much later in its turn the analytical cubist school introduced a new type of artistic assertion, which instead of requiring the observer to have a roving eye which could look at things one after another, attempted to view a scene from several aspects at once, in the hope that new aesthetic values could be captured. Each new artistic movement was built on what had been done before, and each was to some degree freed from the old limitations. So is it with the quantum theory, and relativity, and the whole of modern physics. In science as in art the old is supplemented by the new rather than supplanted by it.

Einstein did not prove that Newton's law of gravitation was wrong. He showed rather that it was limited and consisted of a special vision, strikingly broad in its day, but only a part of a much greater vista which Einstein perceived and flashed to a

startled world. Newton was one of the gaints on whose shoulders Einstein stood to discover this amazing spectacle, which off on the horizon showed time and space, and again matter and energy, as to some degree one and the same. Both men, in their transports of discovery, experienced emotions vaster and deeper even then those which Keats envisaged in "stout Cortez... silent, upon a peak in Darien." Columbus and Magellan bow before the artist and the scientist as explorers.

The scientist is just as likely as his artist cousin to suffer from temperament, and for the same reasons. Both Newton and Einstain, in their young and more productive days, were quite as insufferable in their companions as the deaf Beethoven, found sitting at noon in a darkened room, his piano cluttered with dirty dishes, with a chamberpot beneath. Yet there he was, in Phyllis McGinley's charming phrase, "bending silence into symphonies."

The similarities between Beethoven fitting together a spmphony and Einstein constructing an hypothesis are amazing. The inspiration welling from the subconscious is moulded and polished, examined and adjusted, recast and refurnished, until the

edifice so slowly erected bears the obvious stamp of exactness and of truth.

In the words of James B. Conant: "Scientific discovery began, not in the findings of the laboratory, but in the glimpses of the imagination. The true scientist takes off as the true poet does, not from the notes on his desk, but from a 'hunch' a feel in the bones, an intimation."

The artist must always be willing to forsake the literal and photographic for the sake of deeper truth. This may be thought a basic prerogative of art, but the scientist too must choose among various levels of trueness as he decide which complexities of an experiment to ignore.

No one, save perhaps Balboa's descendants worries because Kents put the wrong explorer on his peak in Darien. After all, the poet was singing about explorers in general, and Cortez scans. And if Kipling stands sometimes condemned, it is because of his outmoded preoccupation with empire, not because his geography was weak. On the road to Mandalay he picked up some of the finest local colour ever shipped west of the Suez.

The artist must rely on many aesthetic feeling for his value judgments. His res-

ponse to truth, after a certain amount of analysis, is largely instinctive and intuitive. Art is meant to be appreciated by the individual. The scientist, however, is trained to dissociate his science from his individuality. He wants to find out how the universe could behave if he and all others who probe it were removed. Heisenberg with his uncertainty principle, Bohr with his complementarity, and others, have shown that there well may exist no manner of bringing this about.

With this important conclusion Einstein felt that he must disagree. It troubled him until his death. His attitude shows that even in science each thinker, no matter how great, is finally led by aesthetic considerations. After almost a score of years of argument with Bohr, Einstein said of Bohr's position : "To believe this is logically possible without contradiction, but it is so very contradictory to my scientific instinct that I connot forego the search for a more complete conception." Though the greatest scientist of many a century is speaking, surely this is an artist.

This "conference at the summit" (for Bohr inherited Einstein's mantle of "greatest living scientist") was a very gentle series

of discussions. The humour, the courtesy, and the mutual esteem of the two partici-paints kept it far from the realm of controversy. Whenever the pair could get together they discussed complementarity and casuality, and the effect of an observer on what he was trying to see in the world of atoms. The tiniest particles cannot be expected to remain uninfluenced by the light waves used to observe them; who then can say how they behave when unobserved? Thus, said Bohr with Heisenberg, some of our "common sense" conclusions about individual atomic occurrences are surely erroneous.

Einstein, while agreeing with Bohr as to logic, could not bring himself to this point of view, and tried endlessly for some way around the difficulty. He would suggest a "think" experiment, a mental exercise on the logic of which both men would agree, which seemed to contradict Bohr's argument. Bohr would retire, a bit puzzled, but the next day would emerge with an explanation of why complementarity was not violated after all. Einstein would be convinced by the specific argument but would remain dissatisfied, and would emerge in his turn with a different example. This, too,

Bohr would after some thought demolish. Always the two would agree on the logical analysis, but still Einstein remained unsatisfied.

Probably most physicists feel that Bohr had the stronger position, and that Einstein was guilty of wishful thinking. There are some who say, however, that the peculiarities of the quantum theory may themselves well spring from the position of man as an observer rather than being intrinsic in the natural world. Thus, while Bohr is correct in his context, Einstein may in the long run prove the more far-seeing of the two. What concerns us here is not the merits of the argument, but the fact that Einstein led to water by logic, could not be satisfied because of the depth of his intuitional thirst.

"Art," says Andre Malraux, "is an age-old struggle to remould the scheme of things." This statement can be paraphrased to fit both science and technology, and to differentiate them. Technology remoulds the thing themselves ; science remoulds the scheme.

Much aesthetic satisfaction comes to the scientist from his occasional ability to use his concepts for predicting. Darwin found, in Madagascar, a very unusual orchid, with throat so deep that it could not possibly be

polinated by any insect known. The great evolutionist promptly predicted that a capable moth would be found, for otherwise this race of orchids would long since have been lost. Sure enough, the moth eventually appeared, its foot-long nectar-sipping tube coiled in a delicate spiral for portability.

Knowing how much of the great beauty of mathematics arises from hard unyielding logic, the scientist is helped to understand the need for classical disciplines in art. Why should there be four movements in a symphony? There need not be, of course, but the aesthetic appeal of art is heightened by discipline ; the facile fails to rouse our interest. Our pleasure in rhyme is less than it used to be, so new forms of poetry appear. Unless the artist disciplines his creativity, however, his works are soon forgotten.

The perspiration of genius comes somewhat from helping to bring ideas to birth, but even more from shaping them with the needed disciplines. Beethoven heard angelic music in his mind, but his notebooks show how thoroughly he worked over each theme, fitting them one to another, and all into a unified whole. Such activity results

in a strong likelihood that a work of art will exceed in its entirety the parts the artist is putting together. Witness the poet who said he could not tell what his poem would be about until it was completed. So with the scientist polishing a new hypothesis. The new relations he discovers are innate, and frequently not of his selection.

Though vast differences still remain between art and science, many of them are matters largely of degree. The scientist must think in rigorous quantitative terms, and he is likely to believe himself impatient with intuition. He considers this vagueness and possibly prejudice. He objects also to taking things on faith. Nevertheless, intuition and faith are both his sharpest tools. What is important is that he follow through to check the results of his intuition and his faith. He knows that his new hypothesis, his work of art, must stand the colse scrutiny of his fellows. They, in assessing it in terms of other parts of the great mural of science, need only rely on the answers nature will give, in the laboratories and in the heavens, to the questions they propound.

Quoting Malraux again: "It is perhaps not a more coincidence that of all the great

masters of painting, the one who had the most far-reaching influence was the only painter for whom art was not his sole interest in life, Leonardo da Vinci." Leonardo was not a scientist, for his inventions lean more to a technology that was centuries too soon, but he had the genius of both science and technology as well as art.

The scientist is deliberately trained to be an intellectual who does not shrink from change, but welcomes and attempts to guide it. Most scientists are far more optimistic about the future of civilization than are the run of poets and painters. "Research," says Kettering, "is nothing but a friendly welcoming attitude toward change. ...It is the tomorrow mind instead of the yesterday mind." Herein may lie the secret of the present ascendancy of scienee.

The resemblances of science and art are far greater than their differences, and deserve more emphasis. Together they share the basic elements of beauty : reduction of chaos to order, of complexity to simplicity and above all, of universality.

SPECIALIZATION IN EDUCATION

Sir Richard Livingstone

Specialization is anyhow inevitable : but it is also desirable and I should like to begin by saying a few words in favour of it. First, some of the major ends of education can be achieved through specialisms—for instance, the training of the intelligence. A student can learn to argue logically, to arrange his thought, to express himself, to distinguish the important from the unimportant, without ever going outside a single field of study, and that is the element of truth contained in the saying that it doesn't matter what a boy is taught provided he is taught it well.

Then, specialization has an educational value of its own, not to be got in any other way. It gives an insight into the meaning of knowledge and into the spirit in which it must be sought. A non-specialized education scratches the surface of the soil and scatters seeds there which, if they spring up at all, have no deep roots. Specialization is deep digging, it enables knowledge to get a firm hold in the soil of the mind and grow into a strong plant.

If I had to choose between a broad education which skims over the surface of a variety of subjects without going thoroughly into at least one : and a narrow education which went deep into something, I would choose the latter in spite of its defects, remembering the saying about a charming woman. "The first time you spoke to her, you thought she knew everything about everything : the second time, you thought she knew everything about everything except the subject on which she was speaking : the third time, that she knew nothing about anything." That is a type of which one must not have too many specimens at large.

Then another point : Specialization is characteristic of the English System far more so than here and our methods have many weaknesses and dangers, but they are not *necessarily* or *always* narrowing. One can't say that politicians like Asquith and Bryce or thinkers like Graham Wallas, and L. T. Hobhouse, Gilbert Murray, Sir Alfred Zimmern, or one of the participants in this congress whose life has been spent in administration in India and who, after retiring from India, has written the classical book about Colonial Administration, Lord Hailey ; one can't say that any of them are

badly educated, and yet their education at school and college was predominantly classical. That rather surprising result is, I think, instructive for our problem, and needs explaining: and the explanation, I think, is this: The English method is not concerned directly with breadths of range. We hold that wide knowledge is less important than quality and direction of intelligence, and that the real danger lies not in specialization but in a specialized habit of mind, which may sometimes result from it but need not do so. So we aim at producing a mind which is interested and alive and which knows how to learn and we think that the latter capacity—the power to learn—can only be developed by specialization. A man educated this way will, we think, go out into the world receptive and alive in mind, with an appetite for knowledge and with the power of acquiring it, so that when he has to master a subject he will know how to do it.

Well, you may say, what then is the objection to specialization? The greatest danger, I think, arises when specialization is in a subject which does not bring the student in touch with human nature, human values. That is why specialization in science and technology (and I mean concentration,

exclusive concentration on those subjects), and, in a lesser degree, in economics, is insidious. Specializings in those subjects you may forget the importance of man, because you don't meet him in them, and specialization in science is a particular danger, because if you pass your life in the company of elements, cells and atoms (or whatever takes the place of atoms), you may be unconsciously inclined to treat men as if they were cells, atoms and elements, and not human beings. It is noticeable that Communism recruits some of its more intelligent adherants from among the scientists. The remedy is to correct any unbalance, any lack of vitamins in the student's diet. But it is not only scientists who need attention. The humanist, without necessarily becoming an expert in any branch of science, must have learned the nature of science and its significance in modern civilization. The masterly chapter in Mr. Conant's latest book says all that needs to be said on that point.

Well, you may ask, "What is your practical prescription for the patient ?" I would suggest one with five main ingredients. First and I put this deliberately first - every one should specialize in something for the good of his mind even if it is not necessary

for his life's works. Second, everyone needs a strong dose of humanism, and by that I mean that he must meet Man, in literature and history, as an individual and as a social being and—which is not quite the same—he must meet him at his best and become penetrated with a sense of the great human values. That raises the question—in what form is humanism best administered to the patient? Of course, there are many forms. Personally, I believe the best is to be found in the study of Graeco-Roman civilization as developed and enlarged by Christianity.

Third, every student should in one way or another become generally aware of the main social and political problems of the day and of the significance of science: I speak of awareness rather than of knowledge.

My next two ingredients are designed to remedy a different kind of specialization. We do not always realize that the age in which we live specializes us and moulds us to its characteristics. Against that specialization, unconscious and, therefore, the more dangerous, we need to be on our guard, to be protected against the besetting sins of our time which are often the excesses of its virtues—the excesses of an age of mechanism, of acquisitiveness, of feverish energy,

of analysis. And so I should add to my medicine two further ingredients.

First, it is essential to see one's own times from outside. To know one's own age, is not enough. We must be able to criticize it; and for criticism a standard of comparison is needed. It is no good beginning history with the nineteenth century. One ought to be able to set our times by the side of some other great civilization, which had a clear view of life, like Ancient Greece or the Middle Ages. Otherwise, we risk being captives of our own day and slaves to its attendant delusions.

My next ingredient is intended to help us to form values of our own. It comes from *Plato*. "It is not," he says, "the life of knowledge, not even if it includes all the sciences, that creates happiness and well being, but a single branch of knowledge, the knowledge of good and evil. If you exclude this from the other branches, medicine will be equally able to give us health, shoemaking, shoes, and weaving clothes. Seamanship will still save life at sea and strategy win battles. But without the knowledge of good and evil, the use and excellence of these sciences will be found to have failed us." Those words were written about fourth century Athens; but

they describle cur own age. We may know everything else that is to be known; we may be—and are—masters of science and technology; we may understand the laws of economics; psychology may have initiated us into human relations; we may have surveyed contemporary civilization and be familiar with the forms of government in every country and the races of men in all stages of their development. But without the science of good and evil, how shall we begin to rule our own lives or see in what direction the world should move? And does education always give us that science?

It is less important to survey civilization than to see it as an effort to achieve excellence, not only in the specialized achieved activities of the mind, but in human character and conduct, the vital element which condition them all, so that we may go into life knowing at least the rudiments of the science of good and evil. That is the light in which the greatest writers in their greatest moments have always seen the world—as a scene of moral and spiritual struggle. The Old Testament is the history of a people but *it* is also an essay in moral philosophy. We call Plato's greatest work "The Republic"; the title he gave to it was "On

Goodness." When Shakespeare wrote "King Lear" he ransacked a variety of sources to compose a play for an Elizabethan theatre; but once embarked on it, he became absorbed not only in a tragedy but also in a clash of good and evil. Here surely, in this sense of spiritual and moral issues, is the coupling-rod which should connect all our specialism.

I do not expect much result from a single bottle of my medicine. The treatment must be repeated at intervals, and I expect the later bottles to be more effective than the first. In other words, I believe in adult education. All of us need a renewal of education, after we have lived in the world and learned something about life, so that we get a chance of thinking afresh about religion, philosophy, history, politics, economics, literature and art, when we have seen at first hand the raw material with which they deal, so that we can for a moment withdraw from the turmoil, and consider our age and ourselves in the light of eternal principles and issues. In adult education—not merely of a technical and vocational, but of a liberal type—I see the greatest hope for the future. But we have not yet taken it seriously.

THE DYING SUN

Sir James Jeans

A few stars are known which are hardly bigger than the earth, but the majority are so large that hundreds of thousands of earths could be packed inside each and leave room to spare; here and there we come upon a giant star large enough to contain millions of millions of earths. And the total number of stars in the universe is probably something like the total number of grains of sand on all the sea-shores of the world. Such is the littleness of our home in space when measured up against the total substance of the universe.

This vast multitude of stars are wandering about in space. A few form groups which journey in company, but the majority are solitary travellers. And they travel through a universe so spacious that it is an event of almost unimaginable rarity for a star to come anywhere near to another star. For the most part each voyages in splendid isolation, like a ship on an empty ocean. In a scale model in which the stars are

ships, the average ship will be well over a million miles from its nearest neighbour, whence it is easy to understand why a ship seldom finds another within hailing distance.

We believe, nevertheless, that some two thousand million years ago this rare event took place, and that a second star, wandering blindly through space happened to come within hailing distance of the sun. Just as the sun and moon raise tides on the earth, so this second star must have raised tides on the surface of the sun. But they would be very different from the puny tides which the small mass of the moon raises in our oceans ; a huge tidal wave must have travelled over the surface of the sun, ultimately forming a mountain of prodigious height, which would rise ever higher and higher as the cause of the disturbance came nearer and nearer. And, before the second star began to recede, its tidal pull had become so powerful that this mountain was torn to pieces and threw off small fragments of itself, much as the crest of a wave throws off spray. These small fragments have been circulating around their parent sun ever since. They are the planets, great and small of which our earth is one.

The sun and the other stars we see in the sky are all intensely hot, far too hot for life to be able to obtain or retain a footing on them. So also no doubt were the ejected fragments of the sun when they were first thrown off. Gradually they cooled, until now they have but little intrinsic heat left, their warmth being derived almost entirely from the radiation which the sun pours down upon them. In course of time, we know not how, when, or why, one of these cooling fragments gave birth to life. It started in simple organisms whose vital capacities consisted of little beyond reproduction and death. But from these humble beginnings emerged a stream of life which, advancing through ever greater and greater complexity, has culminated in beings whose lives are largely centred in their emotions and ambitions, their aesthetic appreciations and the religions in which their highest hopes and noblest aspirations lie enshrined.

Although we cannot speak with any certainty, it seems most likely that humanity came into existence in some such way as this. Standing on our microscopic fragment of a grain of sand, we attempt to discover the nature and purpose of the universe which surrounds our home in space and

time. Our first impression is something akin to terror. We find the universe terrifying because of its vast meaningless distance, terrifying because of its inconceivably long vistas of time which dwarf human history to the twinkling of an eye, terrifying because of our extreme loneliness, and because of the material insignificance of our home in space—a millionth part of a grain of sand out of all the sea-sand in the world. But above all else; we find the universe terrifying because it appears to be indifferent to life like our own; emotion, ambition and achievement: art and religion all seem equally foreign to its plan. Perhaps indeed we ought to say it appears to be actively hostile to life like our own. For the most part, empty space is so cold that all life in it would be frozen; most of the matter in space is so hot as to make life on it impossible; space is traversed, and astronomical bodies continually bombarded, by radiation of a variety of kinds, much of which is probably inimical to, or even destructive of life.

Into such a universe we have stumbled, if not exactly by mistake, at least as the result of what may properly be described as an accident. The use of such a word

need not imply any surprise that our earth exists, for accidents will happen, and if the universe goes on for long enough every conceivable accident is likely to happen in time. It was, I think, Huxley who said that six monkeys set to strum unintelligently on typewriters for millions of millions of years, would be bound in time to write all the books in the British Museum. If we examined the last page which a particular monkey had typed, and found that it had chanced, in its blind strumming, to type a Shakespeare sonnet, we should rightly regard the occurrence as a remarkable accident, but if we looked through all the millions of pages the monkeys had turned off in untold millions of years, we might be sure of finding a Shakespeare sonnet somewhere amongst them, the product of the blind play of chance. In the same way, millions of millions of stars wandering blindly through space for millions of millions of years are bound to meet with every sort of accident, and so are bound to produce a certain limited number of planetary systems in time. Yet the number of these must be very small in comparison with the total number of stars in the sky.

This rarity of planetary systems is im-

portant, because so far as we can see, life of the kind we know on earth could only originate on planets like the earth. It needs suitable physical conditions for its appearance, the most important of which is a temperature at which substances can exist in the liquid state.

The stars themselves are disqualified by being for too hot. We may think of them as a vast collection of fires scattered throughout space, providing warmth in a climate which is at most some four degrees above absolute zero—about 484 degrees of frost on our Fahrenheit scale—and is even lower in the vast stretches of space which lie beyond the Milky Way. Away from the fires there is this unimaginable cold of hundreds of degrees of frost, close up to them there is a temperature of thousands of degrees, at which all solids melt, all liquids boil.

Life can only exist inside a narrow temperate zone which surrounds each of these fires at a very definite distance. Outside these zones life would be frozen; inside it would be shrivelled up. At a rough computation, these zones within which, life is possible, all added together, constitute less than a thousand million millionth part of the

whole of space. And even inside them, life must be of very rare occurence, for it is so unusual an accident for suns to throw off planets as our own sun has done, that probably only about one star in 100,000 has a planet revolving round it in the small zone in which life is possible.

Just for this reason it seems incredible that the universe can have been designed primarily to produce life like our own ; had it been so, surely we might have expected to find a better proportion between the magnitude of the mechanism and the amount of the product. At first glance at least, life seems to be an utterly unimportant bye product ; we living things are somehow off the main line.

We do not know whether suitable physical conditions are sufficient in themselves to produce life. One school of thought holds that as the earth gradually cooled, it was natural, and indeed almost inevitable, that life should come. Another holds that after one accident had brought the earth into being, a second was necessary to produce life. The material constituents of a living body are perfectly ordinary chemical atoms —carbon, such as we find in soot or lamp-black : hydrogen and oxygen, such as we

find in water ; nitrogen, such as forms the greater part of the atmosphere ; and so on. Every kind of atom necessary for life must have existed on the new born earth. At intervals, a group of atoms might happen to arrange themselves in the way in which they are arranged in the living cell. Indeed, given sufficient time, they would be certian to do so, just as certain as the six monkeys would be certain, given sufficient time, to type off a Shakespeare sonnet. But would they then be a living cell ? In other words, is a living cell merely a group of ordinary atoms arranged in some non-ordinary way, or is it something more ? Is it merely atoms, or is it atoms plus life ? Or, to put it in another way, could a sufficiently skilful chemist create life out of the necessary atoms, as a boy can create a machine out of Meccano, *and then make it go* ? We do not know the answer. When it comes it will give us some indication whether other worlds in space are inhabited like ours, and so must have the greatest influence on our interpretation of the meaning of life--it may well produce a greater revolution of thought than Galileo's astronomy or Darwin's biology.

We do, however, know that while living

matter consists of quite ordinary atoms, it consists in the main of atoms which have a special capacity for coagulating into extraordinary large bunches or "molecules."

Most atoms do not possess this property. The atoms of hydrogen and oxygen, for instance, may combine to form molecules of hydrogen (H_2 or H_3), of oxygen or ozone (O_2 or O_3), of water (H_2O), or of hydrogen peroxide (H_2O_2), but none of these compounds contains more than four atoms. The addition of nitrogen does not greatly change the situation ; the compounds of hydrogen, oxygen and nitrogen all contain comparatively few atoms. But the further addition of carbon completely transforms the picture: the atoms of hydrogen, oxygen, nitrogen *and carbon* combine to form molecules containing hundreds, thousands, and even tens of thousands of atoms. It is of such molecules that living bodies are mainly formed. Until a century ago it was commonly supposed that some "vital force" was necessary to produce these and the other substances which entered into the composition of the living body. Then Wohler Produced urea ($CO(NH_2)_2$), which is a typical animal product, in his laboratory by the ordinary processes of chemical

synthesis, and other constituents of the living body followed in due course. Today one phenomenon after another which was at one time attributed to "vital force" is being traced to the action of the ordinary processes of physics and chemistry. Although the problem is still far from solution, it is becoming increasingly likely that what specially distinguishes the matter of living bodies is the presence not of a "vital force," but of the quite commonplace element carbon, always in conjunction with other atoms with which forms exceptionally large molecules.

If this is so, life exists in the universe only because the carbon atom possesses certain exceptional properties. Perhaps carbon is rather noteworthy chemically as forming a sort of transition between the metals and non-metals, but so far nothing in the physical constitution of the carbon atom is known to account for its very special capacity for binding other atoms together. The carbon atom consists of six electrons revolving around the appropriate central nucleus, like six planets revolving round a central sun ; it appears to differ from its two nearest neighbours in the table of chemical elements, the atoms of boron

and nitrogen, only in having one electron more than the former and one electron fewer than the latter. Yet this slight difference must account in the last resort for all the difference between life and absence of life. No doubt the reason why the six-electron atom possesses these remarkable properties resides somewhere in the ultimate laws of nature, but mathematical physics has not yet fathomed it.

Other similar cases are known to chemistry. The phenomenon of permanent magnetism appears in a tremendous degree in iron, and in a lesser degree in its neighbours, nickel and cobalt. The atoms of these elements have 26, 27 and 28 electrons respectively. The magnetic properties of all other atoms are almost negligible in comparison. Somehow, then, although again mathematical physics has not yet unravelled how, magnetism depends on the peculiar properties of the 26, 27 and 28 electron atoms, especially the first. Radio-activity provides a third instance, being confined, with insignificant exceptions, to atoms having from 83 to 92 electrons; again we do not know why.

Thus chemistry can only tell us to place life in the same category as magnetism and

radio-activity. The universe is built so as to operate according to certain laws. As a consequence of these laws, atoms having certain definite numbers, namely 6, 26 to 28, and 83 to 92, have certain special properties, which show themselves in the phenomena of life, magnetism and radio-activity respectively. An omnipotent creator, subject to no limitations whatever, would not have been restricted to the laws which prevail in the present universe ; he might have elected to build the universe to conform to any one of innumerable other sets of laws. If some other set of laws had been chosen, other special atoms might have had other special properties associated with them. We cannot say what, but it seems *a priori* unlikely that either radio activity or magnetism *or life* would have figured amongst them. Chemistry suggests that, like magnetism and radio-activity, life may merely be an accidental consequence of the special set of laws by which the present universe is governed.

Again the word "accidental" may be challenged. For what if the creator of the universe selected one special set of laws just because they led to the appearance of life ? What if this were his way of creating

life? So long as we think of the creator as a magnified man-like being, activated by feelings and interests like our own, the challenge cannot be met, except perhaps by the remark that, when such a creator has once been postulated, no argument can add much to what has already been assumed. If, however, we dismiss every trace of anthropomorphism from our minds, there remains no reason for supposing that the present laws were specially selected in order to produce life. They are just as likely, for instance, to have been selected in order to produce magnetism or radio-activity—indeed more likely, since to all appearances physics plays an incomparably greater part in the universe than biology. Viewed from a strictly material standpoint, the utter insignificance of life would seem to go far towards dispelling any idea that it forms a special interest of the Great Architect of the universe.

A trivial analogy may exhibit the situation in a clearer light. An unimaginative sailor, accustomed to tying knots, might think it would be impossible to cross the ocean if tying knots were impossible. Now the capacity for tying knots is limited to space of three demensions; no knot can be

tied in a space of 1, 2, 4, 5 of any other number of dimensions. From this fact our unimaginative sailor might reason that a beneficent creator must have had sailors under his special patronage, and have chosen that space should have three dimensions in order that tying knots and crossing the ocean should be possibilities in the universe he had created—in brief, space was of three dimensions so that there could be sailors. This and the argument outlined above seem to be much on a level, because life as a whole and the tying of knots are pretty much on a level in that neither of them forms more than an utterly insignificant fraction of the total activity of the material universe.

So much for the surprising manner in which so far as science can at present inform us, we came into being. And our bewilderment is only increased when we attempt to pass from our origins to an understanding of the purpose of our existence or to foresee the destiny which fate has in store for our race.

Life of the kind we know can only exist under suitable conditions of light and heat; we only exist ourselves because the earth receives exactly the right amount of radia-

tion from the sun; upset the balance in either direction, of excess or defect, and life must disappear from the earth. And the essence of the situation is that the balance is very easily upset.

Primitive man, living in the temperate zone of the earth, must have watched the ice-age descending on his homes with something like terror; each year the glaciers came further down into the valleys; each winter the sun seemed less able to provide the warmth needed for life. To him, as to us, the universe must have seemed hostile to life.

We of these later days, living in the narrow temprate zone surrounding our sun and peering into the far future, see an ice-age of a different kind threatening us. Just as Tantalus, standing in a lake so deep that he only just escaped drowning was yet destined to die of thirst, so it is the tragedy of our race that it is probably destined to die of cold while the greater part of the substance of the universe still remains too hot for life to obtain a footing. The sun, having no extraneous supply of heat, must necessarily emit ever less and less of its life-giving radiation, and, as it does so, the temperate zone of space, within which alone life can exist, must close in around it. To

remain a possible abode of life, our earth would need to move in ever nearer and nearer to the dying sun. Yet, science tells us that, so far from its moving inwards, inexorable dynamical laws are even now driving us ever further away from the sun into the outer cold and darkness. And, so far as we can see, they must continue to do so until life is frozen off the earth, unless indeed some celestial collision or cataclysm intervenes to destroy life even ealier by a more speedy death. This prospective fate is not peculiar to our earth; other suns must die like our own, and any life there may be on other planets must meet the same inglorious end.

Physics tells the same story as astronomy. For, independently of all astronomical considerations, the general physical principle known as the second law of thermodynamics predicts that there can be but one end to the universe—a "heat death" in which the total energy of the universe is uniformly distributed, and all the substance of the universe is at the same temperature. This temperature will be so low as to make life impossible. It matters little by what particular road this final state is reached; all roads lead to Rome, and the end of the

journey cannot be other than universal death.

Is this, than, all that life amounts to? To stumble, almost by mistake, into a universe which was clearly not designed for life, and which, to all appearances, is either totally indifferent or definitely hostile to it, to stay clinging on to a fragment of a grain of sand until we are frozen off, to strut our tiny hour on our tiny stage with the knowledge that our aspirations are all doomed to final frustration, and that our achievements must perish with our race, leaving the universe as though we had never been?

Astronomy suggests the question, but it is, I think, mainly to physics that we must turn for an answer. For astronomy can tell us of the present arrangement of the universe, of the vastness and vacuity of space, and of our own insignificance therein; it can even tell us something as to the nature of the changes produced by the passage of time. But we must probe deep into the fundamental nature of things before we can expect to find the answer to our question. And this is not the province of astronomy; rather we shall find that our quest takes us right into the heart of modern physical science.

WHAT LIFE HAS TAUGHT ME

Bertrand Russell

When I undertook to write on this subject, I did not realize how difficult I should find it. Of the things which I now believe, some spring from my own temperament, some from reading and reasoning, and some from experience ; it is only these last that can be said to have been taught me by life. But to separate them from the others is a matter of hazardous psychological conjecture.

When I was young, if I had heard of an elderly man writing on this subject, I should have had very definite expectations. I should have looked for a collection of moralistic platitudes explaining his success, such as ; "Good habits cannot be acquired too early in life. Such modest achievements as may have been mine I attribute to early rising, cold baths, abstinence from tobacco, moderation in alcohol, but above all regular work, day in, day out, with occasional holidoys devoted to healthful exercise in the Alps or on Highland grouse moors." But the splendid certainties of those days are

gone, and I cannot speak to the young of this time with the same hope of imposing on their credulity.

For my part, a large proportion of my activities has been devoted to logic and mathematics, and to the more abstract aspects of the empirical world, such as space and time. On such matters life has nothing to teach ; on the contrary, it has always seemed to me that the spirit of impartiality and detachment which they demand has an important part to play in teaching how life should be lived. Perhaps as a result of these preoccupations I have learnt less from life than most old men have; I have shoght rather, in a platonic spirit, to mould life to a pattern than to mould the pattern to what life would have suggested as the line of least resistance.

But in saying this I am thinking of my adult life. The pattern that has influenced me was, of course, formed by early influences, and might have been very different if I had grown up in a different environment. The Jesuits used to say that the first seven years are decisive ; psycho-analysts sometimes speak as though character were determined by what happens to a child during its first three years. However that may be, I

recognize that, in my own case, my character, tastes, and ideals were, in the main fixed by the time I reached the age of sixteen. Of course many things then were only in embryo, but the seed had been sown, and could only produce a growth of a certain species.

In practical matters I was brought up in the creed of nineteenth-century aristocratic liberalism involving toleration, democracy, freedom of opinion, and respect for the individual. I have never seen any reason to abandon any part of this creed, though I have been more conscious at sometimes than at others of its apparent or temporary limitations. Until 1914 I shared the optimism which then seemed reasonable. Parliamentary institutions were firmly established in America and Western Europe; the German Reichstag was a vigorous body which had every prospect of increasing its power ; Japan had a Diet, Russia acquried its Duma in 1905, and China attempted to adopt democracy in 1912. No reason appeared for doubting that all the world, before long, would be governed by democratic representative institutions.

Toleration, equally, seemed assured of victory. The days when Bradlaugh had

been prevented from taking his seat were in the past; the vindication of Dreyfus led to a liberal era in France. In Germany, it is true, men who made fun of the Kaiser suffered a few months' imprisonment, but I doubt if there is now any country outside Great Britain and the dominions where the penalties for political heresy are as slight as they were in Germany between 1900 and 1914. The intolerance and cruelty of the Tsarist government, which shocked enlightened opinion throughout the world, was provoking a revolutionary opposition from which something infinitely better was to be expected before long.

There was always the possibility of war, but Hague Conferences and the Concert of the powers gave grounds for hope that an explosion could be deferred until the probably not distant date when the Social Democrats acquired control in Germany. And surely, in an epoch of sane progress, men could not be so mad as to jeopardize everything in the gamble of a world conflict. So I, in common with most others of liberal outlook, thought and felt in the years before 1914.

The experience of subsequent years while it has not changed my views as to what

would be desirable, has shown that the road to the realization of nineteenth-century hopes is much longer and more arduous than it had seemed. The forces of obscurantism, irrationality, cruelty, and ruthless strife have shown themselves (temporarily, we may hope) capable of defeating the movement towards ordered progress. A war in defence of freedom, even when victorious, inevitably involves the sacrifice of some part of what is being fought for. The world in which we find ourselves is nearer to the world of Hitler's dreams than it was before 1933 : in this impersonal sense, some part of the victory was his. To take only one instance : there is far more anti-Semitism, both in England and in America than there was before Hitler's persecution of the Jews began. The First World War we were told, was a war to end war, and for a moment it seemed as if it might achieve this object ; but no one dares to maintain that the Second World War can have any such outcome. Instead, the menace of the atomic bomb suggests the futility of all hope for the immediate future of mankind.

This gloomy situation may be met in various ways. The easiest, and perhaps

the most natural, is "let us eat and drink and be merry, for tomorrow we die." If this attitude is widely adopted, there is no doubt that tomorrow we shall die, and not only we. but the whole civilized way of life gradually built up by the Greeks and Romans, Christianity and science. Perhaps it is now too late; perhaps the seeds of death, nourished in the soil of the unbridled lust for power which moralists have never succeeded in curbing, cannot now be prevented from bearing their dreadful fruit ; perhaps the discipline of a dark age is necessary before a saner civilisation can arise. If so, those who say "let us eat and drink" are in the right : fore-thought is folly, and intoxication —alcoholic or spiritual—the only possible alleviation of despair.

But while there remains any chance that this utter pessimism is excessive, I shall refuse to adopt it. There is still a chance of averting disaster, and to increasing that chance all the efforts of those who feel a responsibility towards the world should be directed.

The lessons that life has taught me during the present century are cheerful ones. I have had to admit that sheer cruelty plays a much larger part than I thought in the make-up of a large proportion of mankind,

I have had to admit that, when the present is painful, men, for the most part, will seek alleviation, not in national measures which might produce gradual amelioration, but in myths inspired by hatred and phantasies of power, leading to outbursts of violence which intensify the evils by which they are caused. I have had to admit that when suffering is intense and widespread it generates callousness; largescale atrocities and cruelties which, fifty years ago, would have caused a universal outcry, now pass almost unnoticed unless they can be used to incite to war. I have had to admit that gains are never secure and that benefits to which men have grown accustomed are liable to be carelessly tossed aside in moments of excitement. I have had to face the possibility that perhaps knowledge is a misfortune, and only ignorance can preserve human beings from mutual extermination.

These facts, and others like them, are to be assimilated but afford no argument against the desirability of what they prove to be difficult. We know that democracy is possible since there are countries where it exists; we know that tolerance is possible, for the same reason. If there are populations incapable of the compromise

and mutual forbearance upon which tolerance and the success of democracy depend, that is no reason for not valuing these things, but only for not attempting to approach them by short cuts, and for studying the conditions which, hitherto, have made them possible where they were possible. There is a type of person, all too common in the world of practical affairs, who is determined to be affective at all costs, and who, if he cannot do great, is content to do harm. If he knows how to make dynamite but not how to build houses he will blow up existing buildings, causing a greater racket and a quicker change than any architect could hope to cause. And so, when democracy proves difficult, dictators arise and take pride in the multiplicity of the hopes that they have brought to ruin. If I had to make up moral maxims for the young, my first would be : "It is better to do a little good than much harm."

Respect for the individual—a very, essential part of the Liberal creed—is a less definite matter than democracy or legal toleration, and more hedged about with limitations and provisions. What I mean by it is rather a state of feeling than a definite precept. It is not always possible in

practice, to treat an individual with respect for example, if he is a homicidal maniac. But I will try first to indicate what I mean, and only then consider what life has taught me as to its practicability.

Human beings impinge upon each other in many ways. Where there is food for one, and ten people to eat it, there will be conflict. Where two rivals each desire to be supreme in one community, at least one of them must be disappointed. Where there are many religions, each claiming to be the unique repository of absolute truth and the sole means of eternal salvation, it is difficult for them to live in peace with one another. In the present day, those who believe in State trading and those who believe in private capitalism are finding it very hard to adjust their differences. It is certainly not always possible for conscientious men to avoid violent conflict, since two creeds both impersonal and both held with perfect sincerity, may be mutually incompatible.

But much the greater part of the violence in human relations would be prevented if men could feel and practise the virtue which I am calling "respect for the individual." Primarily, this consists in a great reluctance to inflict humiliation. In former

times hardly anyone (except King Lear when he was mad) saw any harm in this. The stocks and the pillory were opportunities for the jeers of hostile crowds: criminals were branded so that their disgrace became indelible; children were not only flogged, but unmercifully mocked. This sort of thing was dying out during the nineteenth century, but has been revived in recent times. The Nazis, in their milder moods dressed Jews in ridiculous costumes, and drove them through the streets wearing placards saying "I am a Jew." After the liberation of France, female collaborators, shorn of their hair, were exhibited to the execration of their neighbours. In all totalitarian countries, punishment has consisted partly of making its victims, under the influence of torture, behave in ways that destroyed their self-respect; confession, begging for mercy and betraying comrades were the commonest of these ways.

To anyone possessed of sympathy and psychological imagination, this sort of thing is infinitely painful. When a human being has been humiliated beyond a point, something of value in him has been irreparably destroyed. The Stoics maintained that a man could always avoid this damage

by the exercise of his own willpower, but we now know that this is false. There is no one whose will cannot be broken by torture which is sufficiently severe and sufficiently prolonged, but apparently the ancients were less ingenious in their ways than the governmental fiends of our day. The knowledge of these dark facts saps most men's resistance at an early point, since they are aware that it will give way sooner or later. Consider a German who was a Communist till 1933, then a Nazi till 1945, and now (in the Russian Zone) is again a communist. What self-respect can such a man have retained? What crimes will he refuse to perform, and in what atrocities will he be unwilling to bear a part? And almost the whole of the Continent of Europe is full of such men, many of them in positions of some authority.

Aristocratic pride was formerly regarded as a virtue, in part with justice, and in part not; it was a virtue in so far as it consisted in self-respect, but a vice when it involved contempt for inferior mortals. In Spanish peasants I have found the good element of pride without the bad; so I have in all classes in China. But in Western urban communities, and among those who have

submitted to dictatorships, whether of the German or the Russian variety, not only is the good kind of pride usually absent, but there is no willingness to admit that it is virtue. This is due, I think, to the diminution of economic, social, and political independence. It has been revived, to some degree, among Western wage-earners, by the growth of trade unionism. But it is hardly to be expected where success depends upon currying favour with official superiors, or where unguarded candour may lead to execution or the concentration camp. To preserve it should be one of the aims of a good social system. In economic and political relations, and above all in education, self-respect should be carefully guarded, and humiliation avoided to the utmost extent that practical necessities permit.

The problem of combining the greatest practicable degree of respect for the individual with the indispensable controls required for public order, economic justice and technical efficiency, is one of immense difficulty and complexity, requiring hazardous conjectures as to social consequences and a doubtful balancing of one set of ethical values against another.

In the province of education, respect for the child demands that instructions shall, as for as possible, be a matter of co-operation between teacher and pupil, not of a discipline imposed by force without the child's inward assent. It demands also that the beliefs and precepts instilled into the child's mind shall be such as are genuinely believed to be for his good, and not merely such as are convenient to the powers that be and calculated to make him die quietly whenever a predatory government can further its ends by having him killed. These considerations led me to believe in "progressive" education. At the same time, I am compelled to acknowledge that many "progressive" educators, in their zeal for individualism, neglect things that are of great importance. We are not only individuals, but also members one of another; education should make a man not only an upstanding individual, but a useful member of society. This requires, on the one hand, adequate instruction, and on the other hand a social ethic. Everything possible should be done to make children enjoy learning, but learn they must, if they are to play their part in a civilized community. And in a world where organization has

created great forces—churches, political parties, industrial corporations, and above all, armed States—a man who never thinks of himself as a unit in group is impotent unless he is a great creative artist. It is necessary to find a cohesive force as powerful as patriotism, but without the limitations that make patriotism inadequate. Education must take account of the need for collective sentiments, with the correlative concept of social duty.

We need, and shou'd teach in schools, loyalty to something greater than our own nation. It is nationalism that has brought the world to its present terrifying condition and that is making an acceptable solution of international problems so hard to find. The loyalty that is needed is loyalty to Man, and not to Man merely as a biological species, but as the sole embodiment, so far as our knowledge extends, of certain values. Man is capable of creating and appreciating beautiful things he is capable (within limits) of knowledge, he can experience love and admiration and ecstasy. It is ture that he exemplifies also the opposites of these goods : the creation of hideous squalor, wilful ignorance, hatred and envy and anguish. But in spite of all that is horrible and all the insistent incite-

ments to despair, I retain the belief that Man is capable of developing his better potentialities and gradually lessening the intensity of his evil passions. It is this belief, not a narrow nationalism, that should be taught in schools and made the basis of social obligation. It is this belief—so at least it seems to me—that alone supplies an antidote to despair that is rational, and not based upon some comforting myth that invites men to abrogate the primary duty of a sober search for what is true.

For the man who values individual liberty, perhaps the most perplexing of all problems is that of economic organization. The case for Socialism, broadly speaking, is derived from the concept of justice not from that of liberty. But its opponents argue that justice may be too dearly bought if it involves the sacrifice of freedom. This is one of the matters as to which life has taught me most, but unfortunately, its lessons have been mutually contradictory, and have left me somewhat bewildered. Until 1912 I was a Liberal, and felt hesitations about Socialism because I feared that it would diminish freedom. The First World War made me a Socialist, because I thought that Socialist States would be less warlike

than States inspired by predatory capitalism. But the Soviet regime, which I have always abominated as ruthless and dictatorial, showed how easy it is for a nominal Socialism to develop an oligarchical tyranny more thorough-going and disastrous than any that is possible under capitalism. In the substitution of bureaucracy for big business I see no cause for rejoicing.

If Socialism is to be a boon and not a disaster, it must fulfil certain conditions. It must be democratic, in the Western sense, not in the preverted sense that the Soviet Government is endeavouring to popularize. And it is not enough that it should be democratic as a whole ; there must be democracy in the various parts, as was suggested by guild socialism. Take, say, the iron and steel industry. If this industry is in the hands of the State, and its governing officials are appointed by the Government, they will have at least as much power as now belongs to the great capitalists who control the industry. Indeed, they are pretty certain to have more, since strikes against a democratically elecetd government will win less sympathy than strikes do at present. Clearly the solution lies in extending, rather than in curtailing, the functions

of trade unions. Every great industry should be controlled, so far as its internal affairs are concerned, by a trade union co-extensive with the industry. The general public, which is represented by the State, is interested in the amount and price of the product, but the mode of production and the appointment of managers concerns the industry itself, and should be in its hands—subject to an ultimate control by the State in event of gross evils being established by a public inquiry.

Not only the industry as a whole, but each factory should have a measure of self government. If Socialism is not to stifle individual energy and initiative, it must be accompanied by an immense extension of federalism. The general principle that should govern all federal institutions is clear: whatever mainly concerns a subordinate group should be managed by that group, while what concerns its external relations be managed by a federal authority. Thus there are matters concerning a single factory, matters concerning the national iron and steel industry as a whole, matters concerning its relations to the rest of the nation, and matters concerning its relations to the industry in foreign countries. Each

of these should have its own democratically elected authority, with suitably limited powers. Short of some such system, Socialism will merely introduce a new tyranny of officials. And this will not long remain merely a matter of inequality of power; it will soon become—as the development of the U.S.S.R. has shown—a matter of income also. All the old privileges will reappear, without the exceptions and loopholes and irregularities that, in the old system enabled men like Shelley and Darwin to do valuable work of which the community did not see the value.

All the question that I have considered hitherto are overshadowed—and have been overshadowed even since 1914—by the supreme problem of the abolition of war. If this can be solved, it is reasonable to hope that others will be solved in due course; but if it cannot be solved within the next few years, the outlook is one of utter and unmitigated disaster, at any rate for Western Europe, including Great Britain. And even if our complex social organization could survive one more great war, it could not survive a series, each worse than the last, combining continually more destructive forms of atomic energy with

bacteriological warfare. Somehow the habit of war must be ended, and ended soon.

The atomic bomb, while it has made the problem more urgent, has also made its solution much less difficult. The American Government has proffered what would probably develop into an adequate system but Russia has refused to accept the offer. The atomic bomb is such a terrible weapon that, if it were controlled by an international authority, that authority would be able to make aggressive war hopeless. This requires that all nations should submit to inspection by officials representing the international authority, and that any attempt to resist or obstruct their work should be treated as a *causes belli*. The United States, inspite of its initial advantage, is willing to submit to these conditions, but the Soviet Government has rejected the necessary limitation of the veto on the ground that it involves infringement of sovereignty. Without infringement of sovereignty human life, as we have known it, cannot long continue, unless some one nation succeeds in conquering the world.

What the world needs is the elimination of wars between nations by the creation of an international authority, possessed of

irresistible force, and using that force in accordance with an agreed body of international law. The first and most urgent step towards this end is the international control of atomic energy. To this step the Soviet Government is now the only serious obstacle.

Every since the dawn of history communities have oscillated between the opposite poles of dictatorship and anarchy, involving the opposite dangers of ossification and dissolution or forign conquest. Through science the world has become one community, which has to choose between common prosperity and common ruin. But it is as yet an anarchic community destitute of government, filled with hatred and suspicion profoundly obsessed with the archaic belief that one man's gain must be another man's loss. Under the stress of misfortune passions have grown more violent, and fear has increased mutual suspicion. Jews and Arabs, Hindus and Muslims, Chinese Communists and Chinese Notionalists, carry on their little wrangles, while the dispute between Washington and Moscow threatens to reconcile them all in a common grave. The new danger is so vast and so terrible that men shrink from allowing themselves to realize it: they

shrink still more admitting that ancient enemities, burning controversies, and passionate shibboleths have all become absurd. Pathetic and trivirl, like sailors quarrelling over a sixpence while their ship is sinking.

What mankind needs is not law alone, or liberty alone, but each in its own province; law to control impulses of agression and tyranny, freedom for impulses that are creaive or for the common benefit. Various obstacle stand in the way, partly institutional, partly psychological. Of the institutional obstacles the most serious and the most dangerous is national armaments. If this were overcome, the resulting prosperity and relief from fear would gradually promote sanity, and lead to the discovery of methods of diminishing the psychological obstacles of cruelty, envy, greed, and lust for power —methods which would be partly psychological, partly educational, and partly economic. The problem of creating a happy world is not insoluble, provided the will to solve it existed. Will men prefer disaster, or will they acquiesce, however reluctantly, in their own salvation.

EDUCATION AND THE TRAINING OF CHARACTER

Sir Richard Livingstone

EDUCATION is a vast continent and it will make for clearer thinking if we divide it into three main provinces, corresponding to the three main needs of human life. All men need to make a living—not a bare one, but the best that conditions allow. All men live in a society. All men have a personality to develop and the power of living ill or well. For all these education must provide, and it must therefore include a vocational element, a social or, as the Greeks would have called it, a political element, and a spiritual element. Men must learn to earn a living, to be good members of a society, to understand the meaning of the phrase 'the good life'; and education must help them to achieve these three ends. It must do this not for a limited class but for every citizen, though it will do it in different ways for different people.

The new society, then, like every society, will need three main kinds of education—vocational, social, spiritual. It must provide

for its material existence and for the running of its machine, and the education dealing with this may be called vocational. It will need its technologists and skilled workers to feed it, clothe it and supply the necessities, comforts and even luxuries of life ; its doctors, scientists, economists, teachers, administrators. So it will have every variety of technical education, and in its places of higher study it must provide not only for Medicine, Science and Applied Science, but for such subjects as Economics, Psychology, Sociology, Public and Colonial and Business Administration : the list can be completed by studying the Calendar of the London School of Economics. That, of course, is not to say that everyone will study all, or even any, of those subjects. In addition to training the numerous and various specialists which it requires, a society should give its educated members at least, not indeed specialist knowledge, but some perception of the general conditions and possibilities of modern civilisation, and a sense of the importance and uses of the techniques and specialisms essential to it.

Then our society will need social or political education, a training in citizenship, as we call it, which I leave to a later chapter,

passing on to the third aspect of education—that which fits a man for living well. In practice it cannot be saparated from the other two—education for a vocation and for citizenship—but in aim it differs from them. It has no name. You can call it the education of personality, but that word in turn needs definition, and it is simplest to take the old Greek analysis and think of it as the education of body, mind and character to the highest degree of which, each individual is capable. Of this immense subject I shall only touch on a side which, for want of a better word, may be called spiritual. The efficiency of a community will depend on its technical and vocational education, its cohesion and duration largely on its social or political education. But the quality of its civilisation depends on something else. It depends on its standards, its sense of values, its idea of what is first-rate and what is not. The vocational and the social aspects of education are essential, but the most fatal to omit is the spiritual aspect ; fatal, because its absence may be long unperceived and, as with an insidious disease, a State may suffer from it and be unconscious of its condition till the complaint has gone too far to cure. And this spiritual element is

precisely what we tend to ignore. Yet nothing is more needed at the moment. The body of our civilization risks destruction by war, and we are too distressed by that to notice that its soil is 8 already more than half drowned in the turbid river of modern life.

During the last war the salvation of the world was assigned to science. Now we are disillusioned. Science, like medicine, is an integral part of civilised life. It is difficult for human being to maintain health without doctors, but medicine is not health. It is difficult for a civilisation to be sound without science, but science is not civilisation, and few people can suppose that salvation, is its business. Today we tend to assign that role to psychology, economics and sociology. These branches of knowledge are indispensable to our civilisation. We have not enough of them. We need more. But though adjuncts and auxiliaries, they too are not saviours of society, and if we fix our hopes on them the year 1960 will find us much further down the hill and looking for some other force to held us to recover our lost ground. Our knowledge of the sciences, natural or social, fixes the limits of the course within which the yachts on which

humanity is embarked must sail, but does not indicate the goal of their voyage, still less supply wind to fill their sails.

The forces that move the world need to be informed and disciplined by the intellect, but they are not in themselves intellectual. Is there any great event in history which does not bear out that truth ? Economic or social conditions may prepare the way ; the moving force is a vision. The ardour that created modern Germany and modern Russia came from a vision,[1] if it was one seen through blood-shot eyes. An eternal trait of men is the need for vision and the readiness to follow it ; and if men are not given the right vision, they will follow wandering fires. One tragedy of our world is that Hitler had a vision and his opponents had not. The weakness of England and of America is that (with plenty of science and a quantum at least of economics and sociology) they have seen no clear vision. Indistinct and blurred figures stir them in their uneasy sleep, but have not yet taken form. That has been a grave weakness in this war ; it will be a much graver one, when we face the problems of peace.

1. I do not mean to put the two visions on a level.

If we are to cure it, we must look beyond (without overlooking) science, technology, economics, sociology, handicrafts, subjects 'with a vocational bias', and recall and extend a statement by professor Whitehead that would probably surprise most English people: 'Moral education', he says, 'is impossible without—' What? Residential schools, games, a happy and disciplined family life? No, none of these. 'Moral education is impossible without the habitual vision of greatness.' It could not be put more strongly—'*impossible*,' '*habitual* vision' (not a chance and occasional glimpse) Outside Plato, there is no profonder saying about education.

A habitual vision of greatness', is necessary not only to moral education, but to all education. A teacher. cannot give an adequate training in anything unless he knows, and can make his pupil see, what is great and first-rate in it. How can you train a surgeon unless you show him the finest techniques of surgery, or a teacher, unless he knows the best methods of educational practice; or an architect, unless he is familiar with the great examples of his art? So, too, with all subjects from building to farming, from carpentry to Greek prose. Much else

may enter the student's training ; but there is no stimulus like seeing the best work in the subject which he studies ; he will have no standards, no conception of the goal to which he painfully struggles, unless he sees the best ; he will slip insensibly to lower levels of ideal and practice, unless it is continually before his mind, unless, *in fact*, he has the 'habitual vision of greatness' to attract, direct and inspire. In all studies and in all spheres of life, knowledge of the best is essential to success. And if this is necessary in medicine and teaching and architecture and town-planning, must it not be necessary in character ? And is not Whitehead right when he says that you cannot train character 'without the habitual vision of greatness' ? Mere character training in the narrow sense could be carried out by a drill sergeant ; courage endurance, fair-play, discipline, could be learnt on parade ground, and the work would need a far less highly qualified staff than those of school. There is shmething more to character training than this. It is common and disastrous to forget that the character must be trained through the intellect as well as by other means, and that part of the work of education is to enrich

the vision of its pupils and thereby train their characters. A school that fails to do this is failing to do its work. That is a truth of which teachers and pupils cannot too often remind themselves. What more important service can school or university do for their pupils than show them the best things that have been done, thought and written in the world, and fix these in their minds as a standard and test to guide them in life? Men's achievements depend not only on the qualities of character (in the narrow sense) with which they tackle their task but also on knowing what is first rate; ill-success in every field of life is due quite as much to ignorance of what is good as to incapacity to achieve it. One is apt to think of moral failure as due to weakness of character: more often it is due to an inadequate ideal. We detect in others, and occasionally in ourselves, the want of courage, of industry, of persistance which leads to defeat. But we do not notice the more subtle and disastrous weakness, that our standards are wrong, that we have never learnt what is good,

HOW TO WRITE, HOW TO WRITE BADLY AND HOW TO WRITF WELL

C. E M. Joad

The object of *writing is to say* something we want to say—in other words, to convey meaning. This, which should be an easy task, is cosidered by most people to be fraught with difficulty. Writing is thought to be a complicated and highly technical craft, not to be undertaken except by those who have first been initiated into its mys-terries and mastered its technique. So much at least is indispensable for the writing of books, articles and essays. Letters are some how different : letters are only a way of talking on paper, and are therefore, outside the mysterious pale of writing proper.

It is my lot to lecture to a class whose members are obliged to write me an essay once a fortnight. The labour of extracting these essays is Herculean. Every sort and kind of excuse is made to escape them : Snooks is working over time. Jone has for-gotten how to spell, Brown does not know how to express himself and Robinson has

married a wife and cannot spare the time to write. One day I had an idea. I asked Snooks and the rest to write me not an essay, but a letter. The letter was to tell me how they liked the class, what they thought of the other members, what suggestions they had to make for improving the lectures, and what—here I concealed the Gregory powder in the jam—they thought of the subject set for the last essay. The effect was magical: every body suddenly found his pen and, blossoming into expression, gave me the very thing I had been unable to extract when I asked for an essay.

By this experience I was convinced of a truth I had often suspected, that all the talk about style and form and quality of expression in writing which agitates literary circles is simply highfalutin bunkum, designed to hoodwink people into the belief that writing is much more mysterious than it really is, by those whose living depends on the maintenance of the mystery, and that, if the plain man would only take the trouble to say quite plainly what he thinks, good and even easy writing would be the inevitable result.

Yet this is just what the plain man will not do. When, for example, he wants to

write to the papers, and cosiders it incumbent upon him to adopt what he calls a literary style, he thinks that the desired result is to be achieved by using two or three words when one would normally suffice : thus he calls an oyster 'a succulent bivalve', a barber 'a tonsorial artist', and says 'the delectable Duchy' when he means Cornwall. These unfortunate expressions are based upon a false belief, the belief that the object of writing is somehow different from the object of talking, and that, whereas it is the business of the spoken word simply to convey meaning, the business of the written word is to create what is called a literary effect. This false belief is due to two causes.

The first is the poison of journalese. We may agree that the world is sometimes exciting ; it is equally clear that sometimes it is not. But although the world can please itself in the matter, the journalist has no option. Whether we are in the midst of a great war or an August silly season his obligation to be bright, witty and stimulating, and to produce a bright, witty and stimulating paper, remains the same. And if nothing happens to excite or amuse he must make his words do for themselves what events refuse to do for him.

Hence the characteristic of journalism is constant over-emphasis. One way of achieving this emphasis is by the use of unexpected and striking words. Thus the cricket reporter will say 'the sphere struck the uprights' when he wishes to report the fact that the ball hit the stumps. Another method is by gross over-expression, and by gross over-expression I mean the introduction of flowing and highly charged phrases which are altogether disproportionate to the importance of the event or to the sincerity of the writer's feeling.

Supposing, to take an example quoted by Galsworthy (*on Expression*), we want to say. 'The cat was on the mat', and, having nothing else to say, and a yawning half column of space in which to say it, determine to make the statement of this simple fact carry as nuch weight in the way of eloquence and emotion as we can manage to pile on to it. Then, if we are clever at our job, we shall say : Stretching herself with feline grace, and emitting those sounds immemorially connected with satisfaction, Grimalkin lay on a rug whose richly variegated pattern spoke eloquently of the Orient and all the wonders of *The Arabian Nights*.' If we are not clever at our job we shall

succeed in being not impressive but merely funny, like the American journalist who, wishing to report the fact that a mother was dead, sought to arouse emotion by announcing that 'the hand that rocked the cradle had kicked the bucket.'

All this is bad, as bad as bad can be. It is vulgar, it is an offence against simplicity, it is a foe to all good writing. And, since there is no reason at all why we should go out of our way to acquire the habit of journalese, let us, when we sit down to write, take a solemn oath to say exactly what we mean and to say nothing more, to use the simplest words that will serve our purpose, and to use as few of them as we can.

But there is another cause for the belief that writing is something more, and some thing more important, than just talking on paper. Many authors, anxious to exalt the mysteries of their trade, have maintained that writing is an art—in the sense in which the painting of pictures or the composing of music is an art. As an art it possesses a definite technique ; there is an appropriate diction to be learned, judgment exercised in the selection of words, tricks of harmony and rhythm to be mastered. In a word, there is the acquirement of *a style*, and

unless the author has first mastered a style his writing will be of no value.

The belief in style as a thing which is valuable in itself, independently of the meaning it conveys, was very prevalent at the end of the last century. The so-called decadents, led by Oscar Wilde, cared much more about the way in which a thing was said than about what was said.

Samuel Butler has a delightful passage in his famous *Notebooks* on this attitude to writing, which he regards as pretentious cant:

'I never knew a writer yet who took the smallest pains with his style and was at the same time readable...Men like Newman and R. L. Stevenson seem to have taken pains and to acquire what they called a style as a preliminary measure—as something that they had to form before their writings could be of any value. I should like to put it on record that I never took the smallest pain with my style, have never thought about it, and do not know or want to know whether it is a style or whether it is not, as I believe and hope, just common simple straight forwardness. I cannot conceive how any man can take thought for his style without loss to himself and his readers.'

the goes on characteristically to add: 'I have, however, taken all the pains that I had the patience to endure in the improvement of my handwriting....'

In other words a man's style should be like his dress. It should be as unobtrusive and should attract as little attention as possible. Butler is here voicing a conviction which I feel very strongly. Provided that a man feels genuinely on a particular subject, provided also that he has got clearly conceived in his head what he wants to say on that subject, provided, too, that he is careful to say only what he has clearly conceived and nothing more, than, if he has a sufficient knowledge of grammar and the laws of syntax, his thoughts, when he comes to put them down, will automatically express themselves in the mould which we call good writing, while the enthusiast, whose feeling is not merely genuinely but fanatically intense, may unwittingly break out into great writing.

'A true original style,' says Shaw, 'is never achieved for its own sake...Effectiveness of assertion is the beginning and end of style. He who has nothing to assert has no style, and can have none; he who has something to assert will go as far in poerw

of style as its momentousness and his convio ctinwill carry him. isprove his assertion after it is made—yet his style remains.'

No man living writes better English prose than Shah, no man has a more true, original and affective style.

Yet surely, I shall be told, you will admit that there is music and beauty in words. Two men may feel equally strongly, and think equally clearly, upon a given subject yet one will express himself with a passionate as,o moving sincerity that will carry convictin the other in the cold, colourless termn of a Government Blue Book. Should we not aim at achieving that quality, whatever it may be, that clothes with beauty the words of the one, and eschew the official bleakness of the other ? t To this question shall endeavour to suggest an answer in a jurther article.

How to Write Well

On the last occasion on which I wrote about style I committed myself to a proposition which has seemed to most to be platil tudinous in so far as it was true, and untrue in so far as it was not obvious. 'Think clearly.' I said in effect, "say plainly -wha

you have clearly conceived, and good style will automatically result.' But what of beauty, I was asked—of the music of phrases, of the quality that makes one man's words thrill us to ecstasy, while another's leave us unmoved? Surely these things exist, and if they do, should not we endeavour to cultivate them?

I admit the existence and the value of these things, but I do not think that we should consciously seek them. If we do, they will elude us. If a man writes clearly and simply, and avoids both mannerisms and imitation, what he writes will bear the unmistakable impress of his own individuality, so that his words will ring with the peculiar quality of his temperament and vision. If there is beauty in our thought and originality in our views, these qualities will inevitably appear in our expression of them.

Now, just as you cannot make your personality interesting by trying to be original, so you cannot make your style, which is an expression of your personality, interesting by trying to emphasize it or beautiful by trying to adorn it. People who think about themselves, and the effect they are making, succeed only in becoming self-concious

and affected. By the same token authors who take thought for their style, and the effect it is producing, succeed only in being stilted and unnatural; they drop into mannerisms and acquire affectations.

Thus Meredith (1828-1909), though his style rises at times to heights of nobility and eloquence, is a great sinner in this respect; he writes: 'a girl, at chew upon an apple,' when he wants to say: 'a girl chewing an apple.' This is mere affectation, and in moderation is tolerable, but at his worst he achieves monstrosities, such as the famous phrase, 'a rotifer astir in the curative compartment of a homoeopathic globule.

Meredith's object here is to produce a striking effect by an unusual phrase. There are, indeed, all kinds of dodges for securing striking and vivid effects. When used sparingly and with restraint these invest a style with vivacity and freshness. The danger is that we shall overdo them.

One of the commonest is the use of long and many syllabled words when short, simple words would do as well. The greatest writers often do this, to their shame. Dr. Johnson (1709-1784) is one of them. Thus, to take an instance quoted

by Mr. Pocock, he makes one of his young ladies inform us that 'she had not passed the earlier part of life without the flattery of courtship, and the joys of triumph, but had danced that round of gaiety amidst the murmurs of envy and the gratulations of applause; had been attended from pleasure to pleasure by the great, the sprightly and the vain, and had seen her regard solicited by the obsequiousness of gallantry, the gaiety of wit, and the timidity of love.'

The use of long and pompous words is bad, just as the resort to literary dodges is bad, because it is an offence against nature. When you are writing you should be yourself and affectations offend just because they are not self, but a samething deliberately tacked on to the self.

Hazlitt (1778-1830), one of the masters of Engsh prose, tells us that 'to liwre a genuine, familiar, or true English style is to write as anyone would speak in common conversation who had a thorough command and choice of words, or who could discourse with ease, force and perspicuity, setting aside all pedantic and oratorical flourishes.' And, again on the use of common, as opposed to precious, words he

says: "I conecive that words are like money, not the worse for being common, but that it is the stamp of custom alone that gives their circulation a value."

'We are mighty fine fellows, nowadays,' said Stevenson, in his essay on Walking Tours (*Virginibus puerisque*), "but we cannot write like Hazlitt."

Stevenson, for all that he was a finished and polished stylist, would have been a better writter if he had followed Hazlitt's advice more closely. The function of art, he held, was to conceal itself. In other words, one ought to take great pains in order to appear to be taking no pains at all; but the attempt to appear natural by artifice is not naturalism. It is rather two removes from nature.

So that he may learn not to aim at literary effect, the would-be writer should keep a diary. The essence of a diary is that no one should read it but the author. Now, the writer does not wish to impress himself—at least, we trust not—and therefore in a diary he may hope to be not only as truthful but as natural as possible. The value of the diary, not only as a form of self-expression but as a training for style, lies in the fact that the diary—and in this

it is unique among literary productions—is written simply and solely because the author wants to write it. It is a sort of safety valve, the natural outlet for a personality.

The Diary of Samuel Pepys (1631-1703), the most famous of diarists, is written in a style which is absolutely unique and entirely personal. It is not a polished style, sometimes it is not even a grammatical style, yet it is so fresh, so vivid, so revealing and so robust, that it invests the trivial incidents which Pepys records with an interest which no historian has been able to give to the contemporary events of national importance that Pepys does not even condescend to notice; it has caused the Diary to be read with delight and amusement by those who care not a button for what Pepys had for his dinner, or what his wife said to him in the course of their perpetual squabbles.

One other diary I must mention. It is the *Spiritual Diary* of one Dr. Rutty and I speak of it here because it carries to their logical conclusions those characteristics of intimacy and expressiveness which I have praised, and in so doing caricatures them. Dr. Rutty was a divine whose stomach was

constantly at war with his religion. When, as usually happened, his appetite won, Dr. Rutty suffered not only from indigestion but also from his conscience, and we have entries such as: 'A little swinish at dinner.' Dr. Johnson used to chuckle over the Diary of Dr. Rutty.

What, then, are the rules for good writing? They amount to very little. I will quote Mr. Pocock's excellent book for the most obvious: 'Observe accurately, think clearly choose the right words.. be as fresh, brief, and original as you can—and, above all, do not be afraid of being natural.'

But there is no golden rule for good writing, just as there is no golden rule for good living. Writing is an expression of the man; one man's meat is another man's poison, and one man's excellence another's snare. And the great writer may break all the rules and yet remain a great writer.

To return, then, to the question with which I began this article. What of the music and beauty of words? Do I take no account of these? I reply that they are valuable indeed but that they must be suffered to come of themselves. If they refuse, then no amount of trying will make

them. Good architects decorate a construction; they do not construct a decoration, and if you aim directly at Beauty you will miss her. You cannot take the kingdom of beauty by storm any more than you can command a pleasure at will. Happiness is a flower that surprises you, a song which you can hear as you pass the hedge suddenly, simply, rising in the night and dying down again.

And so it is with Beauty. Beauty is not to be captured by direct assault; she is away round the corner ready to dart out and enter our lives when we are busily engaged in doing or achieving something else.

We have only to take one or two examples of perfect harmony of thought and phrasing to see how impossible it is to bring them within the framework of a formula, how completely they mock at our rules. Take this of Shakespeare's:

"Come away, come away, death,
And in sad cypress let me be laid;
Fly away, fly away, breath,
I am slain by a fair cruel maid."

What does he say? 'My girl has jilted me; I want to die.' Yet that commonplace sentiment is conveyed with a beauty which

makes us catch our breath. Or this of Coleridge's (1772—1834) from *The Ancient Mariner* :

"The moving Moon went up the sky
And nowhere did abide :
Softly she was going up,
And a star or two beside."

The beauty of lines such as these is like a fragrance, a subtle essence. Try to capture it, bottle it and label it, with a view to fetching it out when you want to distil some more and you will find it has evaporated, wafted, beyond reach or recall.

And, finally, to the truth of my contention I call the great stylists of our age, Bernard Shaw, Joseph Conrad and W. H. Hudson, the naturalist, to bear witness. The beauty with which their writing is enriched has not been sought, or even summoned, but has come spontaneously and of its own accord to clothe words of a man preaching Socialism, of a man telling a story and of a man absorbed in the wonders of Nature.

LOGIC—LOVE IS A FALLACY

Max Shulman

Cool was I and logical. Keen, calculating, perspicacious, acute and astute : I was all of these. My brain was as powerful as a dynamo, as precise as a chemist's scales, as penetrating as a scalpel. And—think of it !—I was only eighteen.

It is not often that one so young has such a giant intellect. Take, for example Petey Burch, my room-mate at the University of Minnesota. Same age, same background, but dumb as an ox. A nice enough fellow, you understand, but nothing upstairs Emotional type. Unstable. Impressionable. Worst of all, a faddist. Fads, I submit, are the very negation of reason. To be swept up in every new craze that comes along, to surrender yourself to idiocy just because everybody else is doing it—this, to me, is the acme of mindlessness. Not, however, to petey.

One afternoon I found Petey lying on his bed with an expression of such distress on his face that I immediately diagnosed appendicitis. "Don't move," I said. "Don't take a laxative. I'll get a doctor."

"Raccoon," he mumbled thickly.

"Raccoon?" I said, pausing in my flight.

"I want a raccoon coat," he wailed.

I perceived that his trouble was not physical, but mental. "Why do you want a raccoon coat."

"I should have known it," he cried, pounding his temples. "I should have known they'd come back when the Charleston came back. Like a fool I spent all my money for textbooks, and now I can't get a raccoon coat."

"Can you mean," I said incredulously, "that people are actually wearing raccoon coats again?"

"All the Big Men on Campus are wearing them. Where've you been?"

"In the library," I said, naming a place not frequented by Big Men on Campus.

He leaped form the bed and paced the room. "I've got to have a raccoon coat," he said possionately, "I've got to!"

"Petey, why? Look at it. rationally. Raccoon coats are unsanitary. They shed. They smell bad. They weigh too much. They're unsightly. They—"

"You don't understand," he interrupted impatiently. "It's the thing to do. Don't you want to be in the swim?"

"No", I said truthfully.

"Well, I do," he declared. "I'd give anything for a raccoon coat. Anything ?"

My brain, that precision instrument, slipped into high gear. "Anything?" I asked, looking at him narrowly.

"Anything," he affirmed in ringing tones.

I stroked my chin thoughtfully. It so happened that I knew where to get my hands on a raccoon coat. My father had had one in his undergraduate days ; it lay now in a trunk in the attic back home. It also happened that Petey had something I wanted. He didn't *have* it exactly, but at least he had first rights on it. I refer to his girl, Pollty Espy.

I had long coveted Polly Espy. Let me emphasize that my desire for this young woman was not emotional in nature. She was, to be sure, a girl who excited the emotions, but I was not one to let my heart rule my head. I wanted Polly for a shrewdly calculated, entirely cerebral reason.

I was a freshman in law school. In a few years I would be out in practice. I was well aware of the importance of the right kind of wife in furthering a lawyer's career. The successful lawyers I had observed were, almost without exception, married to beanti-

full, gracious, intelligent women. With one omission, Polly fitted these specifications perfectly.

Beautiful she was. She was not yet of pin-up proportions, but I felt sure that time would supply the lack. She already had the makings.

Gracious she was. By gracious I mean full of graces. She had an erectness of carriage, an ease of bearing, a pulse that clearly indicated the best of breeding. At table her manners were exquisite. I had seen her at the Kozy Kampus Korner eating the specialty of the house—a sandwich that contained scraps of pot roast, gravy, chopped nuts, and a dipper of sauerkraut—without even getting er hfingers moist.

Intelligent she was not. In fact, she veered in the opposite direction. But I believed that under my guidance she would smarten up. At any rate, it was worth a try. It is, after all, easier to make a beautiful dumb girl smart than to make an ugly smart girl beautiful.

"Petey," I said, "are you in love with Polly Espy?"

"I think she's a keen kid," he replied, "but I dont't know if you'd call it love. Why?"

"Do you," I asked, "have any kind of formal arrangement with her? I mean are you going steady or anything like that?"

"No. We see each other quite a bit, but we both have other dates. Why?"

"Is there," I asked, "any other man for whom she has a particular fondness?"

"Not that I know of. Why?"

I nodded with satisfaction. "In other words, if you were out of the picture, the field would be open. Is that right?"

"I guess so. What are you getting at?"

"Nothing, nothing." I said innocently, and took my suitcase out of the closet.

"Where are you going?" asked Petey.

"Home for the weekend." I threw a few things into the bag.

"Listen," he said, clutching my arm eagerly, "while you're home, you couldn't get some money from your old man, could you, and lend it to me so I can buy a raccoon coat?"

"I may do better than that," I said with a mysterious wink and closed my bag and left.

"Look," I said to Petey when I got back Monday morning. I threw open the suitcase and revealed the huge, hairy gamy object that my father had worn in his Stutz Bearcat in 1925.

"Holy Toledo!" said Petey reverently. He plunged his hands into the raccoon coat and then his face. "Holy Toledo!" he repeated fifteen or twenty times.

"Would you like it?" I asked.

"Oh yes!" he cried, clutching the greasy pelt to him. Then a canny look came into his eyes. "What do you want for it?"

"Your girl," I said, mincing no words.

"Polly?" he said in a horrified whisper. "You want Polly?"

"That's right."

He flung the coat from him. "Never," he said stoutly.

I shrugged. "Okay. If you don't want to be in the swim, I guess it's your business."

I set down in a chair and pretended to read a book, but out of the corner of my eye I kept watching Petey. He was a torn man. First he looked at the coat with the expression of a waif at a bakery window. Then he turned away and set his jaw resolutely. Then he looked back at the coat, with even more longing in his face. Then he turned away, but with not so much resolution this time. Back and forth his head swiveled, desire waxing, resolution

waning. Finally he didn't turn away at all; he just stood and stared with mad lust at the coat.

"It isn't as though I was in love with Polly," he said thickly. "Or going steady or anything like that."

"That's right," I murmured.

"What's Polly to me, or me to Polly?"

"Not a thing," said I.

"It's just been a casual kick—just a few laughs, that's all."

"Try on the coat," said I.

He complied. The coat bunched high over his ears and dropped all the way down to his shoe tops. He looked like a mound of dead raccoons. "Fits fine," he said happily.

I rose from my chair. "Is it a deal?" I asked, extending hand.

He swallowed. "It's a deal," he said and shook my hand.

I had my first date with Polly the following evening. This was in the nature of a survey; I wanted to find out just how much work I had to do to get her mind up to the standard I required. I took her first to dinner. "Gee, that was a delish dinner," she said as we left the restaurant. Then I took her to a movie. "Gee, that was a marvy movie," she said as we left the

theatre. And, then I took her home. "Gee, I had a sensaysh time," she said as she bade me good night.

I went back to my room with a heavy heart. I had gravely under-estimated the size of my task. This girl's lack of information was terrifying. Nor would it be enough merely to supply her with information. First she had to be taught to think. This loomed as a project of no small dimensions, and at first I was tempted to give her back to Petey. But then I got to thinking about her abundant physical charms and about the way she entered a room and the way she handled a knife and fork, and I decided to make an effort.

I went about it, as in all things, systematically. I gave her a course in logic. It happened that I, as a law student, was taking a course in logic myself, so I had all the facts at my finger tips. "Polly," I said to her when I picked her up on our next date, "tonight we are going over to the Knoll and talk."

"Oo, terrif," she replied. One thing I will say for this girl: you would go far to find another so agreeable.

We went to the Knoll, the campus trysting place, and we sat down under an old

oak, and she looked at me expectantly. "What are we going to talk about?" she asked.

"Logic."

She thought this over for a minute and decided she liked it. "Magnif," she said.

"Logic," I said, clearing my throat, "is the science of thinking. Before we can think correctly, we must first learn to recognize the common fallacies of logic. These we will take up tonight."

"Wow-dow!" she cried, clapping her hands delightedly.

I winced, but went bravely on.

"First let us examine the fallacy called Dicto Simpliciter" "By all means," she urged, batting her lashes eagerly.

"Dicto Simpliciter means an argument based on an unqualified generalization. For example: Exercise is good. Therefore everybody should exercise."

"I agree," said Polly earnestly. "I mean exercise is wonderful. I mean it builds the body and everything."

"Polly," I said gently, "the argument is a fallacy, *Exercise is good* is an unqualified generalization. For instance, if you have heart disease, exercise is bad, not good. Many people are ordered by their doctors

not to exercise. You must *qualify* the generalization. You must say exercise is *usually* good, or exercise is good *for most people*. Otherwise you have committed a Dicto Simpliciter. Do you see ?"

"No," she confessed. "But this is marvy. Do more ! Do more !"

"It will be better if you stop tugging at my sleeve," I told her, and when she desisted, I continued. "Next we take up a fallacy called Hasty Generalization. Listen carefully : You can't speak French. I can't speak French. Petey Burch cant's speak French. I must therefore conclude that nobody at the University of Minnesota can speak French."

"Really?" said Polly, amazed. "*Nobody*?"

I hid my exasperation. "Polly, it's a fallacy. The generalization is reached too hastily. There are too few instances to support such a conclusion."

"Know any more fallacies ?" she asked breathlessly. "This is more fun than dancing even."

I fought off a wave of despair. I was getting nowhere with this girl, absolutely nowhere. Still, I am nothing if not persistent. I continued. "Next comes Post Hoc. Listen to this : Let's not take Bill on

our picnic. Every time we take him out with us, it rains."

"I know somebody just like that," she exclaimed. "A girl back home—Eula Becker, her name is. It never fails. Every single time we take her on a picnic—"

"Polly," I said sharply. "it's a fallacy. Eula Becker doesn't cause the rain. She has no connection with the rain. You are guilty of Post Hoc if you blame Eula Becker."

"I'll never do it again," she promised contritely. "Are you mad at me?"

I sighed deeply. "No, Polly, I'm not mad."

"Then tell me some more fallacies."

"All right. Let's try Contradictory Premises."

"Yes, let's," she chiped, blinking her eyes happily.

I frowned, but plunged ahead. "Here's an example of Contradictory Premises: If God can do anything, can He make a stone so heavy that He won't be able to lift it?"

"Of course," she replied promptly.

"But if He can do anything. He can lift the stone," I pointed out.

"Yeah" she said thoughtfully. "Well, then I guess He can't make the stone."

"But He can do anything." I reminded her.

She scratched her pretty, empty head. "I'm all confused," she admitted.

"Of course you are. Because when the premises of an argument contradict each other, there can be no argument. If there is an irresistible force, there can be no immovable object. If there is an immovable object, there can be no irresistible force. Get it?"

"Tell me more of this keen stuff," she said eagerly.

I consulted my watch. "I think we'd better call it a night. I'll take you home now, and you go over all the things you've learned. We'll have another session tomorrow night."

I deposited her at the girl's dormitory, where she assured me that she had had a perfectly terrif evening, and I went glumly home to my room. Petey lay snoring in his bed, the raccoon coat huddled like a great hairy beast at his feet. For a moment I considered waking him and telling him that he could have his girl back. It seemed clear that my project was doomed to failure. The girl simply had a logic-proof head.

But then I reconsidered. I had wasted

one evening ; I might as well waste another. Who knew ? May be somewhere in the extinct crater of her mind, a few embers still smouldered. May be somehow I could fan them into flame. Admittedly it was not a porspect fraught with hope, but I decided to give it one more try.

Seated under the oak the next evening I said, "Our fiirst fallacy tonight is called Ad Misericordiam."

She quivered with delight.

"Listen closely," I said. "A man applies for a job. When the boss asks him what his qualifications are, he replies that he has a wife and six children at home, the wife is a helpless cripple, the children have nothing to eat, no clothes to wear, no shoes on their feet, there are no beds in the house, no coal in the cellar, and winter is coming."

A tear rolled down each of Polly's pink cheeks. "Oh this is awful," she sobbed.

"Yes, it's awful," I agreed, "but it's no argument. The man never answered the boss's question about his qualifications. Instead he appealed to the boss's sympathy. He committed the fallacy of Ad Misericordiam. Do you understand ?"

"Have you got a handkerchief ?" she blubbered.

I handed her a handkerchief and tried to keep from screaming while she wiped her eyes. "Next," I said in a carefull controlled tone, "we will discuss False Analogy. Here is an example: Students shonld be allowed to look at their textbooks during examinations. After all, surgeons have X-rays to guide them during an operation, lawyers have briefs to guide them during a trial, carpenters have blueprints to guide them when they are building a house. Why, then, shouldn't students be allowed to look as their textbooks during an examination?"

"There now," she said enthusiastically, "is the most marvy idea I've heard in years."

"Polly," I said testily, "the argument is all wrong. Doctors, lawyers, and carpenters aren't taking a test to see how much they have learned, but students are. The situations are altogether different, and you can't make an analogy between them."

"I still think it's a good idea," said Polly.

"Nuts," I muttered. Doggedly I pressed on. "Next we'll try Hypothesis Contrary to Fact."

"Sounds yummy," was Polly's reaction.

"Listen: If madame Curie had not happened to leave a photographic plate in a

drawer with a chunk of pitchblende, the world today would not know about radium."

"True, true," said Polly, nodding her head. "Did you see the movie? Oh, it just knocked me out. That Walter Pidgeon is so dreamy. I mean he fractures me."

"If you can forget Mr. Pidgeon for a moment," I said coldly, "I would like to point out that the statement is a fallacy. May be Madame Curie would have discovered radium at some later date. May be somebody else would have discovered it. May be any number of things would have happened. You can't start with a hypothesis that is not true and then draw any supportable conclusions from it."

"They ought to put Walter Pidgeon in more pictures," said Polly. "I hardly ever see him any more."

One more chance, I decided. But just one more. There is a limit to what flesh and blood can bear. "The next fallacy is called Poisoning the Well."

"How cute!" she gurgled.

"Two men are having a debate. The first one gets up and says, 'My opponent is a notorious liar. You can't believe a word that he is going to say.' . . . Now, Polly, think. Think hard. What's wrong?"

I watched her closely as she knit her creamy drow in concentration. Suddenly a glimmer of intelligence—the first I had seen ...came into her eyes. "It's not fair," she said with indignation. "It's not a bit fair. What chance has the second man got if the first man calls him a liar before he even begins talking?"

"Right!" I cried exultantly. "One hundred percent right. It's not fair. The first man has *poisoned the well* before anybody could drink from it. He has hamstrung his opponent before he could even start......Polly, I'm proud of you."

"Pshaw," she murmured, blushing with pleasure.

"Yes see, my dear, these things are't so hard. All you have to do is concentrate. Think—examine—evaluate. Come now, let's review everything we have learned."

"Fire away," she said with an airy wave of her hand.

Heartened by the knowledge that Polly was not altogether a cretin, I began a long patient review of all I had told her. Over and over and over again I cited instances, pointed out flaws, kept hammering away without let up. It was like digging a tunnel. At first everything was work, sweat, and

darkness. I had no idea when I would reach the light, or even if I would. But I persisted. I pounded and clawed and scraped, and finally I saw a chink of light. And then the chink got bigger and the sun came pouring in and all was bright.

Five gruelling nights this book, but it was worth it. I had made a logician out of Polly ; I had taught her to think. My job was done. She was worthy of me at last. She was a fit wife for me, a proper hostess for my many mansions, a suitable mother for my well-heeled children.

It must not be thought that I was without love for this girl. Quite the contrary. Just as pygmalion loved the perfect women he had fashioned, so I loved mine. I determined to acquaint her with my feelings at our very next meeting. The time had come to change our relationship from academic to romantic.

"Polly," I said when next we sat beneath our oak, "tonight we will not discuss fallacies."

"Aw, gee," she said, disappointed.

"My dear," I said, favouring her with a smile, "we have now spent five evenings together. We have gotten along splendidly. It is clear that we are well matched."

"Hasty Generalization," said Polly brightly.

"I beg your pardon," said I.

"Hasty Generalization," she repeated. "How can you say that we are well matched on the basis of only five dates?"

I chuckled with amusemsnt. The dear had learned her lessons well. "My dear," I said, patting her hand in a tolerant manner, "five dates is plenty. After all, you don't have to eat a whole cake to know that it's good."

"False Analogy," said Polly promptly. "I'm not a cake. I'm a girl."

I chuckled with somewhat less amusement. The dear child had learned her lessons perhaps too well. I decided to change the tactics. Obviously the best approach was a simple, strong, direct declaration of love. I paused for a moment while my massive brain chose the proper words. Then I began:

"Polly, I love you. You are the whole world to me, and the moon and the stars and the constellations of outer space. Please, my darling, say that you will go steady with me, for if you will not, life will be meaningless. I will languish. I will refuse my meals. I will wander the face of the 'earth,' a shambling, hollow eyed hulk."

There, I thought, folding my arms, that ought to do it.

"Ad Misericordiam," said Polly.

I ground my teeth. I was not Pygmalion; I was Frankenstein, and my monster had me by the throat. Frantically I fought back the tide of panic surging through me. At all costs I had to keep cool.

"Well, Polly," I said forcing a smile, "you certainly have learned your fallacies."

"You're darn right," she said with a vigorous nod.

"And who taught them to you, Polly?"

"You did."

"That's right. So you do owe me something, don't you, my dear? If I hadn't come along you never would have learned about fallacies."

"Hypothesis Contrary to Fact," she said instantly.

I dashed perspiration from my brow. "Polly," I croaked, "you mustn't take all these things so literally. I mean this is just classroom stuff. You know that the things you learn in school don't have anything to do with life."

"Dicto Simpliciter," she said, wagging her finger at me playfully.

That did it. I leaped to my feet, bellow-

ing like a bull. "Will you or will you not go steady with me?"

"I will not," she replied.

"Why not?" I demanded.

"Because this afternoon I promised Petey Burch that I would go steady with him."

I reeled back, overcome with the infamy of it. After he promised, after he made a deal, after he shook my hand; "The rat!" I shrieked, kicking up great chunks of turf. "You can't go with him, Polly. He's a liar. He is a cheat. He's a rat."

"Poisoning the Well," said Polly, "and stop shouting. I think shouting must be a fallacy too."

With an immense effort of will, I modulated my voice. "All right," I said. "You're a logician. Let's look at this thing logically. How could you choose Petey Burch over me? Look at me—a brilliant student, a tremendous intellectual, a man with an assured future. Look at Petey—a knothead, a jitterbug, a guy who'll never know where his next meal is coming from. Can you give me one logical reason why you should go steady with Petey Burch?"

"I certainly can," declared Polly, "He,s got a raccoon coat."

THE MAN IN ASBESTOS : AN ALLEGORY OF THE FUTURE

Stephen Leacock

To begin with let me admit that I did it on purpose. Perhaps it was partly from jealousy.

It seemed unfair that other writers should be able at will to drop into a sleep of four or five hundred years, and to plunge headfirst into a distant future and be a witness of its marvels.

I wanted to do that too.

I always had been, I still am, a passionate student of social problems. The world of today with its roaring machinery, the unceasing toil of its working classes, its strife, its poverty, its war, its cruelty, appals me as I look at it. I love to think of the time that must come some day when man will have conquered nature, and the toil-worn human race enter upon an era of peace.

I loved to think of it, and I longed to see it.

So I set about the thing deliberately.

What I wanted to do was to fall sleep after

the customary fashion, for two or three hundred years at least, and wake and find myself in the marvel world of the future.

I made my preparations for the sleep.

I bought all the comic papers that I could find, even the illustrated ones. I carried them up to my room in my hotel: with them I brought up a pork pie and dozens and dozens of doughnuts. I ate the pie and the doughnuts, then set back in the bed and read the comic papers one after the other. Finally, as I felt the awful lethargy stealing upon me, I reached out my hand for my *London Weekly Times*, end held up the editorial page befoer my eye.

It was, in a way, clear, straight suicide, but I did it.

I could feel my senses leaving me. In the room across the hall there was a man singing. His voice, that had been loud, came fainter and fainter through the trance. I fell into a sleep, the deep immeasurable sleep in which the very existence of the outer world was hushed. Dimly I could feel the days go past, then the years, and then the long passage of the centuries.

Then, not as it were gradually, but quite suddenly, I work up, sat up, and looked about me.

Where was I ?

Well might I ask myself.

I found myself lying, or rather sitting up, on a broad couch. I was in a great room, dim, gloomy, and dilapidated in its general appearance, and apparently, from its glass cases and the suffered figures that they contained, some kind of museum.

Beside me sat a man. His face was hairless, but neither old nor young. He wore clothes that looked like the grey ashes of paper that had burned and kept its shape. He was looking at me quiety, but with no particular surprise or interest.

"Quick," I said, eager to begin ; "where am I ? Who are you ? What year is this ; is it the year 3,000, or what is it ?"

He drew in his breath with a look of annoyance on his face.

"What a queer, excited way you have of speaking," he said.

"Tell me," I said again, "is this the year 3,000 ?"

"I think I know what you mean," he said "but really haven't the faintest idea. I should think it must be at least that. within a hundred years or so ; but nobody has kept track of them for so long, it's hard to say."

"Don't you keep track of them any more ?" I gasped.

"We used to," said the man. "I myself can remember that a century or two ago there were still a number of people who used to try to keep track of the year, but it died out along with so many other faddish think of that kind. "Why," he continued, showing for the first time a sort of animation in his talk, "what was the use of it ? You see, after we eliminated death--"

"Eliminated death !" I cried, sitting upright. "Good God !"

"What was that expression you used ?" queried the man.

"Good God !" I repeated.

"Ah," he said, "never heard it before. But I was saying that after we had eliminated Death, and Food, and Change, we had practically got rid of Events and—"

"Stop !" I said, my brain reeling. "Tell me one thing at a time."

"Humph !" he ejaculated. "I see, you must have been asleep a long time. Go on then and ask questions. Only, if you don't mind, just as few as possible, and please don't get interested or excited."

Oddly enough the first question that sprang to my lips was—

"What are those clothes made of ?"

"Asbestos," answered the man. They last hundreds of years. We have one suit each, and there are billions of them piled up, if any body wants a new one."

"Thank you," I answered. "Now tell me where I am ?"

"You are in a museum. The figures in the cases are specimens like yourself. But here," he said, "if you want really to find out about what is evidently a new epoch to you, get off your platform and come out on Broadway and sit on a bench."

I got down.

As we passed through the dim and dust-covered buildings, I looked curiously at the figures in the cases.

"By Jove !" I said, looking at one figure in blue clothes with a belt and baton, "that's a policeman !"

"Really," said my new acquaintance, "is that what a *policeman* was ? I've often wondered. What used they to be used for ?"

"Used for ?" I repeated in perplexity. "Why, they stood at the corner of the street."

"Ah, yes, I see," he said, "so as to shoot at the people. You must excuse my ignorance," he continued, "as to some of your social customs in the past. When I took

my education I was operated upon for social history, but the stuff they used was very inferior."

I didn't in the least understand what the man meant, but had no time to question him for at that moment we came out upon the street, and I stood riveted in astonishment.

Broadway! Was it possible? The change was absolutely appalling! In place of the roaring thoroughfare that I had known, this silent, moss-grown desolation. Great buildings fallen into ruin through the sheer stress of centuries of wind and weather, the sides of them coated over with a growth of fungus and moss! The place was soundless. Not a vehicle moved. There were no wires over-head—no sound of life or movement except, here and there, there passed slowly to and fro human figures dressed in the same asbestos clothes as my acquaintance, with the same hairless faces, and the same look of infinite age upon them.

Good heavens! And was this the area of the Conquest that I had hoped to see! I had always taken for granted, I do not know why, that humanity was destined to move forward. This picture of what seemed desolation on the ruins of our civilisation rendered me almost speechless.

There were little benches placed here and there on the street. We sat down.

"Improved, isn't it," said the man in asbestos, "since the days when you remember it?"

He seemed to speak quite proudly.

I gasped out a question.

"Where are the street cars and the motors?"

"Oh, done away with long ago," he said; "how awful they must have been. The noise of them!" and his asbestos clothes rustled with a shudder.

"But how do you get about?"

"We don't," he answered, "Why should we? It's just the same being here as being anywhere else." He looked at me with an infinity of dreariness in his face.

A thousand questions surged into my mind at once. I asked one of the simplest.

"But how do you get back and forward to your work?"

"Work!" he said, "There isn't any work. It's finished. The last of it was all done centuries ago."

I looked at him a moment open mouthed. Then I turned and looked against at the great desolation of the street with the asbestos figures moving here and there.

I tried to pull my senses together. I realised that if I was to unravel this new and undreamed of future, I must go at it systematically and step by step.

"I see," I said after a pause, "that momentous things have happened since my time. I wish you would let me ask you about it all systematically, and would explain it to me bit by bit. First, what do you mean by saying that there is no work?"

"Why," answered my strange acquaintance, "it died out of itself. Machinery killed it. If I remember rightly, you had a certain amount of machinery even in your time. You had done very well with steam, made a good beginning with electricity, though I think radial energy had hardly as yet been put to use."

I nodded assent.

"But you found it did you no good. The better your machines, the harder you worked. The more things you had the more you wanted. The space of life grew swifter and swifter. You cried out but it would not stop. You were all caught in the cogs of your own machine. None of you could see the end."

"That is quite true," I said, "How do you know it all?"

"Oh," answered the Man in Asbestos,

"that part of my education was very well operated—I see you do not know what I mean. Never mind, I can tell you that later. Well, then, there came, probably almost two hundred years after your time, the Era of the Great Conquest of Nature, the final victory of Man and Machinery."

"They did conquer it?" I asked quickly with a thrill of the old hope in my veins again.

"Conquered it," he said, "beat it out! Fought it to a standstill! Things came one by one, then faster and faster, in a hundred years it was all done. In fact, just as soon as mankind turned its energy to decreasing its needs instead of increasing its desires, the whole thing was easy. Chemical Food came first. Heavens! the simplicity of it. And in your time thousands of million of people tilled and grubbed at the soil from morning till night. I've seen specimens of them—farmers, they called them. There's one in the museum. After the invention of Chemical Food we piled up enough in the emporiums in a year to last for centuries. Agriculture went overboard. Eating and all that goes with it, domestic labour, housework—all ended. Nowadays one takes a concentrated pill every year or so, that's

all. The whole digestive apparatus, as you knew it was a clumsy thing that had been bloated up like a set of bagpipes through the evolution of its use !"

I could not forbear to interrupt. "Have you and these people," I said "no stomach —no apparatus ?"

"Of course we have," he answered, "but we use it to some purpose, Mine is largely filled with my education—but there ! I am anticipating again. Better let me go on as I was. Chemical Food came first : that cut off almost one-third of the work and then came Asbestos Clothes. That was wonderful ! In one year humanity made enough suits to last for ever and ever. That, of course, could never have been if it hadn't been connected with the revolt of women and the fall of Fashion."

"Have the Fashions gone," I asked, "that insane, extravagent idea of—" I was about to launch into one of my old-time harangues about the sheer vanity of decorative dress, when my eye rested on the moving figures in asbestos, and I stopped.

"All gone," said the Man in Asbestos. "Then next to that we killed, or practically killed, the changes of climate, I don't think that in your day you properly understood

how much of your work was due to the shifts of what you called the weather. It meant the need of all kinds of special clothes and houses and shelters, a wilderness of work. How dreadful it must have been in your day—wind and storms, great wet masses—what did you call them ?—clouds—flying through the air, the ocean full of salt, was it not ?—tossed and torn by the wind, snow thrown all over everything, hail, rain—how awful !"

"Sometimes," I said, "it was very beautiful. But how did you alter it ?"

"Killed the weather ;" answered the Man in Asbestos. "Simple as anything—turned its forces loose one against the other, altered the composition of the sea so that the top became all more or less gelatinous. I really can't explain it, as it is an operation that I never took at school, but it made the sky grey, as you see it, and the sea gum-coloured, the weather all the same. It cut out fuel and houses and an infinity of work with them !"

He paused a moment. I began to realise someting of the course of evolution that had happened.

"So," I said, "the conquest of nature

meant that presently there was no more work to do ?"

"Exactly," he said, "nothing left."

"Food enought for all ?"

"Too much," he answered.

"Houses and clothes ?"

"All y u like," said the Man in Asbestos, waving his hand. "There they ara. Go out and take them. Of course, they're falling down—slowly, very slowly. But they'll last for centuries yet, nobody need bother."

Then I realised, I think for the first time, just what work had meant in tee old life, and how much of the texture of life itself had been bound up in the keen effort of it.

Presently my eyes looked upward : dangling at the top of a moss—grown building I saw what seemed to be the remains of telephone and all the system of communication?"

"Oh," said the Man in Asbestos, "that was what a telephone meant, was it? I knew that it had been suppressed centuries ago. Just what was it for ?"

"Why," I said with enthusiasm, "by means of the telephone we could talk to anybody and talk at any distance."

"And anybody could call you up at any time and talk ?" said the Man in Asbestos, with something like horror. "How awful !

What a dreadful age yours was, to be sure. No, the telephone and all the rest of it, all the transportation and intercommunication was cut out and forbidden. There was no sense in it. You see," he added, "what you don't realise is that people after your day became gradually more and more reasonable. Take the railroad, what good was that ? It brought into every town a lot of people from every other town. Who wanted them ? Nobody. When work stopped and commerce ended, and food was needless, and the weather killed, it was foolish to move about. So it was all terminated. Anyway," he said, with a quick look of apprehension and a change in his voice, "it was dangerous !"

"So !" I said. "Dangerous ! You still have danger ?"

"Why, yes," he said, "there's always the danger of getting broken."

"What do you mean," I asked.

"Why," said the Man in Asbestos, "I suppose it's what you would call being dead. Of course in one sense there's been no death for centuries past ; we cut that out. Disease and death were simply a matter of germs. We found them one by one. I think that even in your day you had found,

one or two of the easier, the bigger one ?"

I nodded.

"Yes, you had found diphtheria and typhoid, and, if I am right, there were some outstanding, like scarlet fever and smallpox, that you called ultra-microscopic, and which you were still hunting for, and others that you didn't even suspect. Well, we hunted them down one by one and destroyed them. Strange that it never occurred to any of you that Old Age was only a germ! It turned out to be quite a simple one, but it was so distributed in its action that you never even thought of it."

"And you mean to say," I ejaculated in amazement, looking at the Man in Asbestos, "that nowadays you live for ever ?"

"I wish," he said, "that you hadn't that peculiar, excitable way of talking; you speak as if everything mattered so tremendously, Yes," he continued, "we live for ever, unless, of course, we get broken. That happens sometimes. I mean that we may fall over a high place or bump on something, and snap ourselves. You see, we're just a little brittle still,—some remnant, I suppose, of the Old Age germ—and we have to be careful. In fact," he continued, "I don't mind saying that accidents of this sort were the most

distressing feature of our civilisation till we took steps to cut out all accidents. We forbid all street cars, street traffic, aeroplanes, and so on. The risks of your time," he said, with a shiver of his asbestos clothes, "must have been awful."

"They were," I answered, with a new kind of pride in my generation that I had never felt before, "but we thought it part of the duty of brave people to—"

"Yes, yes," said the Man in Asbestos impatiently, "please don't get excited. I know what you mean. If was quitey irrational."

We sat silent for a long time. I looked about me at the crumbling buildings, the monotone, unchanging sky, and the dreary, empty street. Here, then, was the fruit of the Conquest, here was the elimination of work, the end of hunger and of cold, the cessation of the hard struggle, the downfall of change and death—nay, the very millennium of happiness. And yet, somehow, there seemed something wrong with it all. I pondered, then I put two or three rapid questions, hardly waiting to reflect upon the answers.

"It there any war now ?"

"Done with centuries ago. They took to settling international disputes with a slot

machine. After that all foreign dealings, were given up. Why have them? Everybody thinks foreigners awful."

"Are there any newspapers now?"

"Newspaper, ! What on earth would we want them for? If we should need them at any time there are thousands of old ones piled up. But what is in them, anyway; only things taat *happen*, wars and accidents and work and death. When these went newspapers went too. Listen," continued the Man in Asbestos, "you seem to have been something of a social reformer, and yet you don't understand the new life at all. You don't understand how completely all our burdens have disappeared. Look at it this way. How used your people to spend all the early part of their lives?"

"Why," I said, "our first fifteen years or so were spent in getting education."

"Exactly," he answered; now notice how we improved on all that. Education in our day is done by surgery. Strange that in your time nobody realised that education was simply a surgical operation. You hadn't the sense to see that what you really did was to slowly remodel, carve and convolute the inside of the brain by a long and painful mental operation. Everything learn-

ed was reproduced in a physical differnce to the brain. You knew that, but you didn't see the full consequences. Then come the invention of surgical education—the simple system of opening the side of the skull and engrafting into it a piece of prepared brain. At first, of course, they had to use, I suppose, the brains of dead people and that was ghastly"—here the Man in Asbestos shuddered like a leaf—"but very soon they found how to make moulds that did just as well. After that it was a mere nothing; an operation of a few minutes would suffice to let in poetry or foreign languages or anythings else that one cared to have. Here, for instance," he added, pushing back the hair at the side of his head and showing a scar beneath it, "is the mark where I had my spherical trigonometry let in. That was, I admit, rather painful, but other thing, such as English poetry or history, can be inserted absolutely without the least suffering. When I think of your painful, barbarous methods of education through the ear, I shudder at it. Oddly enough, we have found lately that for a great many things there is no need to use the head. We lodge them—things like philosophy and metaphysics, and so on—in

what used to be the digestive apparatus. They fill it admirably."

He paused a moment. Then whet on:

"Well, then, to continue, what used to occupy your time and effort after your education?"

"Why," I said, "one had, of course, to work, and then, to tell the truth, a great part of one's time and feeling was devoted toward the other sex, towards falling in love and finding some woman to share one's life."

"Ah," said the Man in Asbestos, with real interest. "I've heard about your arrangements with the women, but never quite understood them. Tell me; you say you selected some woman?"

"Yes."

"And she become what you called your wife?"

"Yes, of course."

"And you worked for her?" asked the Man in Asbestos in astonishment.

"Yes."

"And she did not work?"

"No," I answered, "of course not."

"And half of what you had was hers?"

"Yes."

"And she had the right to live in your house and use your things?"

"Of course," I answered.

"How dreadful !" said the Man in Asbestos.

"I hadn't realised the horrors of your age till now."

He sat shivering slightly, with the same timid look in his face as before.

Then it suddenly struck me that of the figures on the street, all had looked alike.

"Tell me," I said, "are there no women now ? Are they gone too ?"

"Oh, no," answered the Man in Asbestos, "they're here just the same. Some of those are women. Only, you see, everything has been changed now. It all came as part of their great revolt, their desire to be like the men. Had that begun in your time ?"

"Only a little," I answered : "they were beginning to ask for votes and equality."

"That's it," said my acquaintance, "I couldn't think of the word. Your women, I believe, were something awful, were they not ? Covered with feathers and skins and dazzling colours made of dead things all over them ? And they laughed, did they not, and had false teeth, and at any moment they could inveigle you into one of those contrasts ! Ugh !"

He souddered.

"Asbestos," I said (I knew no other name to call him), as I turned on him in wrath, "Asbestos, do you think that those jelly-bag Equalities out on the street there, with their ash-barrel suits, can be compared for one moment with our unredeemed, unreformed, heaven created, hobble skirted women of the twentieth century?"

"Then, suddenly, another thought flashed into my mind—"

"The children," I said, "where are the children? Are there any?"

"Children," he said, "no! I have never heard of there being any such things for at least a century. Horrible little hobgoblins they must have been? Great big faces, and cried constantly! And grew, did they not? Like funguses! I believe they were longer each year then they had been the last and —"

I rose.

"Asbestos!" I said, "this, then, is your coming civilisation, your millennium. This dull, dead thing, with the work and the burden gone out of life, and with them all the joy and the sweetness of it. For the old struggle—mere stagnation, and in place of danger and death, the dull monotony of security and the horror of an unending

decay ! Give me back." I cried, and I flung wide my arms to the dull air, "the old life of danger and stress, with its hard toi' and its bitter chances, and its heart-br ks. I see its value ! I know its worth ! G e me no rest," I cried aloud—

"Yes, but give a rest to the rest of the corridor ! cried an angered voice that broke in upon my exultation."

Suddenly my sleep had gone.

I was back again in the room of my hotel, with the hum of the wicked, busy old world all about me, and loud in my ears the voice of the indignant man across the corridor.

"Quit your blattling, you infernal blatherskite," he was calling. "Come down to earth." I came.

THE MAN WHO COULD WORK MIRACLES

H. G. Wells

It is doubtful whether the gift was innate. For my own part, I think it came to him suddenly. Indeed, until he was thirty he was sceptic, and did not believe in miraculous powers. And here, since it is the most convenient place, I must mention that he was a little man, and had eyes of a hot brown, very erect red hair, a moustache with ends that he twisted up, and freckles. His name was George McWhirter Fotheringay—not the sort of name by any means to lead to any expectation of miracles—and he was clerk at Gomshott's. He was greatly addicted to assertive argument. It was while he was asserting the impossibility of miracles that he had its first intimation of his extraordinary powers. This particular argument was being held in the bar of the Long Dragon, and Toddy Beamish was conducting the opposition by a monotonous but effective "*So you say*," that drove Mr. Fotheringay, to the very limit of his patience.

There were present, besides these two, a very dusty cyclist, landlord Cox and Miss Maybridge, the perfectly respectable and rather portly barmaid of the Dragon. Miss Maybridge was standing with her back to Mr. Fotheringay, washing glasses; the other were watching him, more or less amused by the present ineffectiveness of the assertive method. Goaded by the Torres Vedras tactics of Mr. Beamish, Mr. Fotheringay determined to make an unusual rhetorical effort. "Look here, Mr. Beamish," said Mr. Fotheringay. "Let us clearly understand what a miracle is. It's something contrariwise to the course of nature done by power of Will, something what couldn't happen without being specially willed."

"So *you* say," said Mr. Beamish, repulsing him.

Mr. Fotheringay appealed to the cyclist, who had hitherto been a silent auditor, and received his assent—given with a hesitating cough and glance at Mr. Beamish. The landlord would express no opinion, and Mr. Fotheringay, returning to Mr. Beamish received the unexpected concession of a qualified assent to his definition of a miracle.

"For instance," said Mr. Fotheringay,

greatly encouraged. "Here would be a miracle. That lamp, in the natural course of nature, couldn't burn like that upsy-down, could it, Beamish?"

"You say it couldn't," said Beamish.

"And you?" said Fotheringay. "You don't mean to say – eh?"

"No," said Beamish reluctantly. "No, it couldn't."

"Very well," said Mr. Fotheringay. "Then here comes someone, as it might be me, along here, and stands as it might be here, and says to that lamp, as I might do, collecting all my will—'Turn upsy-down without breaking, and go on burning steady,' and—Hullo!"

It was enough to make anyone say "Hullo!" the impossible, the incredible, was visible to them all. The lamp hang inverted in the air burning quietly with its flame pointing down. It was as solid, as indisputable as ever a lamp was, the prosaic common lamp of the Long Dragon bar.

Mr. Fotheringay stood with an extended forefinger and the knitted brows of one anticipating a catastrophic smash. The cyclist, who was sitting next to the lamp, ducked and jumped across the bar. Everybody jumped, more or less. Miss Maybridge

turned and screamed. For nearly three seconds the lamp remained still. A faint cry of mental distress came from Mr. Fotheringay. "I can't keep it up," he said "any longer." He staggered back, and the inverted lamp suddenly flared, fell against the corner of the bar, bounced aside, smashed upon the floor, and went out.

It was lucky it had a metal receiver, or the whole place would have been in a blaze. Mr. Cox was the first to speak and his remark, shorn of needless excrescences, was to the effect that Fotheringay was a fool. Fotheringay was beyond disputing even so fundamental a proposition as that! He was astonished beyond measure at the thing that had occurred. The subsequent conversation threw absolutely no light on the matter so far as Fotheringay was concerned: the general opinion not only followed Mr. Cox very closely but very vehemently. Every one accused Fotheringay of a silly trick, and presented him to himself as a foolish destroyer of comfort and security. His mind was in a tornado of perplexity, he was himself inclined to agree with them, and he made a remarkably ineffectual opposition to the proposal of his departure.

He went home flushed and heated, coat-

collar crumpled, eyes smarting and ear red. He watched each of the ten street lamps nervously as he passed it. It was only when he found himself alone in his little bedroom in Church Row that he was able to grapple seriously with his memories of the occurrence, and ask, "What on earth happened?"

He had removed his coat and boots, and was sitting on the bed with his hands in his pockets repeating the text of his defence for the seventeenth time. "I didn't want the confounded thing to upset," when it occurred to him that at the precise moment he had said the commanding words he had inadvertently willed the thing he said, and that when he had seen the lamp in the air he had felt that it depended on him to maintain it there without being clear how this was to be done. He had not a particularly complex mind or he might have stuck for a time at that "inadvertently willed," embracing, as it dose, the abstrusest problems of voluntary action; but as it was, the idea came to him with a quite acceptable haziness. And from that, following, as I must admit, no clear logical path, he came to the test of experiment.

He pointed resolutely to his candle and collected his mind, though he felt he did a

foolish thing. "Be raised up," he said. But in a second that feeling vanished. The candle was raised, hung in the air one giddy moment, and as Mr. Fotheringay gasped, fell with a smash on his toilet-table leaving him in darkness save for the expiring glow of its wick.

For a time Mr. Fotheringay sat in the darkness, perfectly still. "It did happen, after all," he sad. "And how I'm to explain it, I don't know." He sighed heavily, and began feeling in his pockets for a match. He could find none, and he rose and groped about the toilet-table. "I wish I had a match," He said. He resorted to his coat, and there were none there. and then it dawned upon him that miracles were possible even with matches. He extended a hand and scowled at it in the dark. "Let there be a match in that hand," he said. He felt some light object fall across his palm, and his fingers closed upon a match.

After several ineffectual attempts to light this, he discovered it was a safety-match. He threw it down, and then it occurred to him that he might have willed it lit. He did, and perceived it burning in the midst of his toilet-table mat. He caught it up hastily, and it went out. His perception of

possibilities enlarged, and he felt for and replaced the candle in its candlestick. "Here! *you* be lit," said Mr. Fotheringay, and forthwith the candle was flaring, and he was a little black hole in the toilet-cover, with a wisp of smoke rising from it. For a time he stared from this to the little flame and back, and then looked up and met his own gaze in the looking glass. By this help he communed with himself in silence for a time.

"How about miracles now?" said Mr. Fortheringay at last, addressing his reflection.

The subsequent meditations of Mr. Fotheringay were of severe but confused description. So far as he could see, it was a case of pure willing with him. The nature of his first experiences disinclined him for any further experiments except of the most cautious type. But he lifted a sheet of paper, and turned a glass of water pink and then green, and he created a snail, which he miraculously annihilated, and got himself a miraculous new tooth-brush. Somewhere in the small hours he had reached the fact that his will-power must be of a particularly rare and pungent quality, a fact of which he had certainly had inklings

befores, but no certain assurance. The scare and perplexity of his first discovery was now qualified by bride in this evidence of singularity and by vague intimations of advantage. He became aware that the church clock was striking one, and as it did not occur to him that his daily duties at Gomshott's might be miraculously dispensed with, he resumed undressing, in order to get to bed without further delay. As he struggled to get his shirt over his head, he was struck with a brilliant idea. "Let me be in bed," he said, and found himself so. "Undressed," he stipulated; and, finding the sheets cold, added hastily, "and in my night-shirt—no, in a nice soft woollen night-shirt. "Ah!" he said with immense enjoyment. "And now let me be comfortably asleep..."

He awoke at his usual hour and was pensive all through breakfast time, wondering whether his over-night experience might not be a particularly vivid dream. At length his mind turned again to cautious experiments. For instance, he had three eggs for breakfast; two his landlady had supplied, good, but shoppy, and one was delicious fresh goose egg, laid, cooked, and served by his extraordinary will. He hurried off to

Gomshott's in a state of profound but carefully concealed excitement and only remembered the shall of the third egg when his landlady spoke of it that night. All day he could do no work because of this astonishingly new self-knowledge, but this causad him no inconvenience, because he made up for it miraculously in his last ten minutes.

As the day wore on, his state of mind passed from wonder to elation, albeit the circumstances of his dismissal from the Long Dragon were still disagreeable to recall, and a garbled account of the matter that had reached his colleagues led to some badinage. It was evident he must be careful how he lifted fragile articles, but in other ways his gift promised more and more as he turned it over in his mind. He intended among other things to increase his personal property by unostentatious acts of creation. He called into existence a pair of very splendid diamond studs, and hastily annihilated them again as young Gomshott came across the counting-house to his desk. He was afraid young Gomshott might wonder how he had come by them. He was quite clearly the gift required caution and watchfulness in its exercise, but so far as he could judge the difficulties attending its mastery would be no greater than those he had

already faced in the study of cycling. It was that analogy, perhaps, quite as much as the feeling that he would be unwelcome in the Long Dragon, that drove him out after supper into the lane beyond the gas-works, to rehearse a few miracles in private.

There was possibly a certain want of originality in his attempts, for apart from his will-power Mr. Fotheringay was not a very exceptional man. The miracle of Moses' rod came to his mind, but the night was dark and unfavourable to the proper control of large miraculous snakes. Then he recollected the story of "Tannhauser" that he had read on the back of the Philharmonic programme. That seemed to him singularly attractive and harmless. He stuck his walking-stick—a very nice Poona-Penang lawyer—into the turf that edged the footpath, and commanded the dry wood to blossom. The air was immediately full of the scent of roses, and by means of a match he saw for himself that this beautiful miracle was inndeed accomplished. His satisfaction was ended by advancing footsteps. Afraid of a premature discovery of his powers, he addressed the blossoming stick hastily: "Go back." What he meant was "Change back;" but of course he was confused. This stick

receded at a considerable velocity, and incontinently came a cry of anger and a bad word from the approaching person. "Who are you throwing brambles at, you fool ?" cried a voice. "That got me on the shin."

"I'm sorry, old chap," said Mr. Fotheringay, and then realising the awkward nature of the explanation, caught nervously at his moustache. He saw Winch, one of the three Immering constables, advancing."

"What d'yer mean by it?" asked the constable "Hullo ! It's you, is it ? The gent that broke the lamp at the Long Gragon !"

"I don't mean anything by it," said Mr. Fotheringay. "Nothing at all."

"What d'yer do it for then ?"

"Oh, brother !" said Fotheringay.

"Brother indeed ! D'yer know that stick hurt ? What D'yer do it for, eh "?

For the moment Mr. Fotheringay could not think what he had done it for. His silence seemed to irritate Mr. Winch. "You've been assaulting the police young man, this time. That's what *you* done."

"Look here, Mr. Winch," said Mr. Fotheringay, annoyed and confused, "I'm very sorry. The fact is—"

"Well ?"

He could think of no way but the truth.

"I was working a miracle." He tried to speak in an off hand way, but try as he would he couldn't.

"Working a—! 'Ere, don't you talk rot. Working a miracle, indeed ! Miracle ! Well, that's down right funny ! Why, you's the chap that don't believe in miracles. .Fact is. this is another of your silly conjuring tricks —that's what this is. Now, I tell you—"

But Mr. Fotheringay never heard what Mr. Winch was going to tell him. He realised he had given himself away, flung his valuable secret to all the winds of heaven. A violent guest of irritation swept him to action. He turned on the constable swiftly and fiercely. "Here," he said, "I've had enough of this, I have ! I'll show you a silly conjuring trick, I will ! Go to Hades ! Go now !"

He was alone !

Mr. Fotheringay performed no more miracles that night, nor did he trouble to see what had become of his flowering stick. He returned to the town, scared and very quiet, and went to his bedroom. "Lord !" he said, "it's a powerful gift—an extremely powerful gift. I didn't hardly mean as much as that. Not really...I wonder what Hades is like !"

Me sat on the bed taking off his boots. Struck by a happy thought he transferred the constable to San Francisco, and without any more interference with normal causation went soberly to bed. In the night he dreamt of the anger of Winch.

The next day Mr. Fotheringay heard two interesting items of news. Someone had planted a most beautiful climbing rose against the elder Mr. Gomshott's private house in the Lullaborough Road, and the river as far as Rawling's Mill was to be dragged for Constable Winch.

Mr. Fotheringay was abstracted and thoughtful all that day, and performed no miracles except certain provisions for Winch, and the miracle of completing his day's work with punctual perfection in spite of all the bee-swarm of thoughts that hummed through his mind. And the extraordinary abstraction and meekness of his maner was remarked by several people, and made a matter for jesting. For the most part he was thinking of Winch.

On Sunday evening he went to chapel and oddly enough, Mr. Maydig, who took a certain interest in occult matters, preached about "things that are not lawful." Mr. Fotheringay was not a regulary chapel goer,

but the system of assertive scepticism, to which I have already alluded was now very much shaken. The tenor of the sermon threw an entirely new light on these novel gifts, and he suddenly decided to consult Mr. Maydig immediately after the service. So soon as that was determined, he found himself wandering why he had not done so before.

Mr. Maydig, a lean excitable man with quite remarkably long wrists and neck, was gratified at a request for a private conversation from a young man whose carelessness in religious matters was a subject for general remark in the town. After a few necessary delays, he conducted him to the study of the Manse, which was contiguous to the chapel, seated him comfortably, and, standing in front of a cheerful fire—his legs threw a Rhodian arch of shadow on the opposite wall—requested Mr. Fotheringay to state his business.

At first Mr. Fotheringay was a little abashed, and found some difficulty in opening the matter. "You will scarcely believe me, Mr. Maydig, I am afraid"—and so forth for some time. He tried a question at last, and asked Mr. Maydig his opinion of miracles.

Mr. Maydig was still saying "Well in an extremely judicial tone, when Mr. Fotheringay interrupted again: "You don't believe, I suppose, that some common sort of person—like myself, for instance--as it might be sitting her now, might have some sort of twist inside him that made him able to do things by his will."

"It's possible," said Mr. Maydig. "Some thing of the sort, perhaps, is possible."

"If I might make free with something here, I think I might show you by a sort of experiment," said Mr. Fotheringay." Now, take that tobacco-jar on the table, for instance. What I want to know is whether what am going to do with it is a miracle or not. Just half a minute, Mr. Maydig, please."

He knitted his brows, pointed to the tobacco-jar and said: "Be a bowl of violets."

The tobacco-jar did as it was ordered.

Mr. Maydig stared voilently at the change, and stood looking from the thaumaturgist to the bowl of flowers. He said nothing Presently he ventured to lean over the table and smell the violets; they were fresh-picked and very fine ones. Then he stared at Mr. Fotheringay again.

"How did you do that ?" he asked.

Mr. Fotheringay pulled his moustache. "Just told it—and there you are. Is that a miracle, or is it black art, or what is it ? And what do you think's the matter with me ? That's what I want to ask."

"It's most extraordinary occurrence."

"And this day last week I knew no more that I could do things like that than you did. It came quite sudden. It's something odd about my will. I suppose, and that's as far as I can see."

"Is that—the only thing. Could you do other things besides that ?"

"Lord, yes?" said Mr. Fotheringay. "Just anything." He thought, and suddenly recalled a conjuring entertainment he had seen. "Here ! "He pointed, "Change into a bowl of fish—no, not that—change into a glass bowl full of water with goldfish swimming in it. That's better ! You see that Mr. Maydig ?"

It's astonishing. It's incredible. You are either a most extraordinary. But no..."

"I could change it into anything," said Mr. Fotheringay. "Just anything. Here : be a pigeon, will you ?"

In another moment a blue pigeon was fluttering round the room and making Mr.

Maydig duck every time it came near him. "Stop there, will you," said Mr. Fotheringay; and the pigeon hung motionless in the air. "I cou'd change it back to a bowl of flowers," he said, and after replacing the pigeon on the table worked that miracle. "I expect you will want your pipe in a bit," he said, and restored the tobacco-jar.

Mr. Maydig had followed all these later changes in a sort of ejaculatory silence. He stared at Mr. Fotheringay and, in a very gingerly manner, picked up the tobacco-jar, examined it, replaced it on the table, "Well" was the only expression of his feelings.

"Now, after that it's easier to explain what I came about," said Mr. Fotheringay; and proceeded to a lengthy and involved narrative of his strange experiences, begin, ning with the affair of the lamp in the Long Dragon and complicated by persistent allusions to Winch. As he went on, the transient pride Mr. Maydig's consternation had caused passed away; he became the very ordinary Mr. Fotheringay of everyday intercourse again. Mr. Maydig listened intently, the tobacco jar in his hand, and his bearing changed also with the course of the narrative. Presently, while Mr. Fother-

ingay was dealing with the miracle of the third egg, the minister interrupted with a fluttering extended hand—

"It is possible," he said. "It is credible. It is amazing, of course, but it reconciles a number of difficulties. The power to work miracles is a gift—a peculiar quality like genius of second sight—hitherto it has come very rarely and to exceptional people. But in this case...I have always wondered at the miracles of Mahomet, and at Yogi's miracles and the miracles of Madame Blavatsky. But, of course! Yes, it is simply a gift! carries out so beautifully the arguments of that great thinker"—Mr. Maydig's voice sank—"his Grace the Duke of Argyll. Here we plumb some profounder law—deeper than the ordinary laws of nature. Yes—yes. Go on. Go on!"

Mr. Fotheringay proceeded to tell of his misadventure with Winch, and Mr. Maydig, no longer overawed or scared, began to jerk his limbs about and interject astonishment. "It's this what troubled me most," proceeded Mr. Fotheringay: "It's this I'm most urgently in want of advice for; of course he's at San Francisco—wherever San Francisco may be...but of course it's awkward for both of us, as you'll see, Mr. Maydig, I

don't see how he can understand what has happened, and I dare say he's scared and exasperated, something tremendous, and trying to get at me. I dare say he keeps on starting off to come here. I send him back, by a miracle, every few hours, when I think of it. And of course, that's a thing he won't be able to understand, and it's bound to annoy him; and, of course, if he takes a ticket every time it will cost him a lot of money. I did the best I could for him, but of course it's difficult for him to put himself in my place. I thought afterwards that his clothes might have got scorched, you know —if Hades is all it's supposed to be—before I shifted him. In that case I suppose they'd have locked him up in San Francisco. Of course I willed him a new suit of clothes on him directly I thought of it. But, you see I'm already in a deuce of a tangle—"

Mr. Maydig looked serious. "I see you are in a tangle. Yes, it's a difficult position. How yau are to end it..." He became diffused and inconclusive.

"However, we'll leave Winch for a little and discuss the larger question. I don't think this is a case of the black art ot anything of the sort. I don't think there is any taint of criminality about it all, Mr. Fother-

ingay—none whatever, unless you are suppressing material facts. No, it's miracles—pure miracles—miracles. If I may say so, of the very highest class."

He began to pace the hearthrug and gesticulate, while r. Fotheringay sat with his arm on the table and his head on his arm, looking worried. "I don't see how I'm to manage about Winch," he said.

"A gift of working miracles—apparently a very powerful gift," said Mr. Maydig, "will find a way about Winch—never fear. My dear Sir, you are a most important man—a man of the most astonishing possibilities. As evidence, for example! And in other ways, the things you may do..."

"Yes, *I've* thought of a thing or two," said Mr. Fotheringay. "But—some of the things came a bit twisty. You saw that fish at first? Wrong sort of bowl and wrong sort of fish. And I thought I'd ask someone."

"A proper course," Mr. Maydig, "a very proper course—altogether the proper course." He stopped and looked at Mr. Fotheringay. "It's practically an unlimited gift. Let us test your powers, for instance. If they really *are*......If they really are all they seem to be."

And so, incredible as it may seem, in the study of the little house behind the Congregational Chapel, on the evening of Sunday, Nov. 10, 1896, Mr. Fotheringay, egged on and inspired by Mr. Maydig, began to work miracles. The reader's attention is specially and definitely called to the date. He will object, probably has already objected, that certain points in this story are improbable, that if any things of the sort already described had indeed occurred, they would have been in all the papers a year ago. The details immediately following he will find particularly hard to accept, because among other things they involve the conclusion that he or she, the reader in question, must have been killed in a violent and unprecedented manner more than a year ago. Now a miracle is nothing if not improbable, and as a matter of fact the reader *was* killed in a violent and unprecedented manner a year ago. In the subsequent course of this story that will become perfectly clear and credible, as very right-minded and reasonable reader will admit. But this is not the place for the end of the story, being but little beyond the hither side of the middle. And at first the miracles worked by Mr. Fotheringay are timid little miracles—little things with

the cups and parlour fitments, as feeble as the miracles of Theosophists, and, feeble as they were, they were received with awe by his collaborator. He would have preferred to settle the Winch business out of hand, but Mr. Maydig would not let him. But after they had worked a dozen of these domestic trivialities, their sense of power grew, their imagination began to show signs of stimulation, and their ambition enlarged. Their first larger enterprise was due to hunger and the negligence of Mrs. Minchin, Mr. Maydig's housekeeper. The meal to which the minister conducted Mr. Fotheringay was certainly ill laid and un-inviting as refreshment for two industrious miracle workers; but they were seated, and Mr. Maydig was descanting in sorrow rather than in anger upon his housekeeper's shortcomings, before occurred to Mr. Fotheringay that an opportunity lay before him. "Don't you think, Mr. Maydig," he said, "if it isn't a liberty, I—"

"My dear Mr. Fotheringay! of course! No—I didn't think."

Mr. Fotheringay waved his hand. "What shall we have?" he said, in a large, inclusive spirit, and, at Mr. Maydig's order, revised the supper very thoroughly. "As for

me," he said eyeing Mr. Maydig's selection, "I am always particularly fond of tankard of stout and a nice Welsh rarebit, and I'll order that. I ain't much given to Burgundy," and forthwith stout and Welsh rarebit promptly appeared at his command.

They sat long at their supper, talking like equals, as Mr. Fotheringay presently perceived with a glow of surprise and gratification, of all the miracles they, would presently do. "And by the bye, Mr. Maydig," said Mr. Fotheringay, "I might perhaps be able to help you—in a domestic way."

"Don't quite follow," said Mr. Maydig, pouring out a glass of mirculous old Burgundy.

Mr. Fotheringay helped himself to a second Welsh rarebit out of vacancy, and took a mouthful. "I was thinking," he said, "I might be able (*chum, chum*) to work (*chum chum*) a miracle with Mrs. Minchin (*chum chum*)—make her better women."

Mr. Maydig put down the glass and looked doubtful. "She's—She strongly objects to interference, you know, Mr. Fotheringay. And—as a matter of fact—it's well past eleven and she's probably in bed and asleep. Do you think, on whole—"

Mr. Fotheringay considered these objec-

tions. "I don't see that it shouldn't be done in her sleep."

For a time Mr. Maydig opposed the idea, and then he yielded. Mr. Fotheringay issued his orders, and a little less at their ease, perhaps, the two gentlemen proceeded with their repast. Mr. Maydig was enlarging on the changes he might expect in his housekeeper next day, with an optimism that seemed even to Mr. Fotheringay's supper senses a little forced and hectic, when a series of confused noises from upstairs bagan. Their eyes exchanged interrogations, and Mr. Maydig left the room hastily. Mr. Fotheringay heard him calling up to his housekeeper and then his footsteps going softly up to her.

In a minute or so the minister returned, his step light, his face radiant. "Wonderful!" he said, "and touching! Most touching!"

He began pacing the hearthrug, "A repentance—a most touching repentance—through the crack of the door. Poor woman! A most wonderful change! She had got up. She must have got up at once. She had got up out of her sleep to smash a private bottle of brandy in her box. And to confess it too!...But this gives us...it opens—a most

amazing vis'a cf possibilities. If we can work this miraculous change in *her*..."

"The thing's unlimited seemingly," said Mr. Fotheringay. "And about Mr. Winch—"

"Altogether unlimited." And from the hearthrug Mr. Maydig, waving the Winch difficulty aside, unfolded a series of wonderful proposals—proposals he invented as he weht along.

Now what those proposals were does not concern the essentials of this story. Suffice it that they were designed in a spirit of infinite benevolence, the sort of benevolence that used to be called post-prandial. Suffice it too, that the problem of Winch remained unsolved. Nor is it necessary to describe how far that series got to its fulfilment. There were astonishing changes. The small hours found Mr. Maydig and Mr. Fotheringay careering across the chilly market-square under the still moon, in a sort of ecstasy of thaumaturgay, Mr. Maydig all flap and gesture, Mr. Fotheringay short and bristling, and no longer abashed at his greatness. They had reformed every drunkard in the Parliamentary division, changed all the beer and alcohol to water (Mr. Maydig had overruled Mr. Fotheringay on his point), they had, further, greatly

improved the railway communication of the place, drained Flinder's swamp, improved the soil of One Tree Hill, and cured the Vicar's wart. And they were going to see what could be done with the injured pier at South Bridge, "The place," gasped Mr. Maydig, "won't be the same place to-morrow. How surprised and thankful everyone will be!" And just at that moment the church clock struck three.

"I say," said Mr. Fotheringay, "that's three o'clock! I must be getting back. I've to go to be at business by eight. And besides Mrs. Wimms —"

"We're only beginning," said Mr. Maydig, full of the sweetness of ultimited power. "We're only beginning. Think of all the good we're doing. When people wake—"

"But...," said Mr. Fotheringay.

Mr. Maydig gripped his arm suddenly. His eyes were bright and wild. "My dear chap" he said, "there's no hurry. Look"... he pointed to the moon at the zenith...... "Joshua."

"Joshua?" said Mr. Fotheringay.

"Joshua," said Mr. Maydig "Why not Stop it."

Mr. Fotheringay looked at the moon.

"That's a bit tall," he said after a pause.

"Why not?" said Mr. Maydig. "Of course it doesn't stop. You stop the rotation of the earth, you know. Time stops. It isn't as if we were doing harm."

"H'm!" said Mr. Fotheringay. "Well." He sighed. "I'll try. Here—".

He buttoned up his jacket and addressed himself to the habitable globe, with as good as assumption of confidence as lay in his power. "Just stop rotating, will you," said Mr. Fotheringay.

Incontinently he was flying head over heels through the air at the rate of dozens of miles a minute. In spite of the innumerable circles he was describing per second, he thought: - for thought is wonderful—sometimes as sluggish as flowing pitch, sometimes as instantaneous as light. He thought in a second, and willed. "Let me come down safe and sound. Whatever else happens, let me come down safe and sound."

He willed it only just in time; for his clothes, heated by his rapid flight through the air, were already beginning to singe. He came down with a forcible, but by no means injurious bump in what appeared to be a mound of fresh-turned earth. A large mass of metal and masonry, extraordinarily like the clocktower in the middle of the

market-square, hit the earth near him; ricochetted over him, and flew into stonework, bricks, and masonry, like a bursting bomb. A hurtling cow hit one of the large blocks and smashed like an agg. There was a crash that made all the most violent crashes of his past life seem like the sound of falling dust, and this was followed by a descending series of lesser crashes. A vast wind roared throughout earth and heaven, so that he could scarcely lift his head to look. For a while he was too breathless and astonished even to see where he was or what had happened. And his first movement was to feel his head and reassure himself that his streaming hair was still his own.

"Lord !" gasped Mr. Fotheringay, scarce able to speak for the gale, "I've had a squeak ! What's gone wrong ? Storms and thunder. And only a minute ago a fine night. It's Maydig set me on to this sort of thing. *What* a wind ! If I go on fooling in this way I'm bound to have a thundering accident ! .."

"Where's Maydig ?"

"What confounded mess everything's in !"

He looked about him so far as his flapping jacket would permit. The appearance

of things was really extremely strange, "The sky's all right anyhow," said Mr. Fotheringay. "And that's about all that is all right. And even there it looks like a terrific gale coming up. But there's the moon overhead. Just as it was just now. Bright as midday. But as for the rest— Where's the village? Where's—where's anything? And what on earth set this wind a-blowing? I didn't order no wind."

Mr. Fotheringay struggled to get to his feet in vain, and after one failure, remained on all fours, holding on. He surveyed the moonlit world to leeward, with the tails of his jacket streaming over his head. "There's something seriously wrong," said Mr. Fotheringay. "And what it is—goodness knows."

Far and wide nothing was visible in the white glare through the haze of dust that drove before a screaming gale but tumbled masses of earth and heaps of inchoate ruins, no trees, no houses, no familiar shapes, only a wilderness of disorder vanishing at last into the darkness beneath the whirling columns and streamers, the lightnings and thunderings of a swiftly rising storm. Near him in the livid glare was something that might once have been an elm-tree, a smashed

mass of splinters, shivered from boughts to base, and further, a twisted mass of iron girders only too evidently the viaduct—rose out of the piled confusion.

You see, when Mr. Fotheringay had arrested the rotation of the solid globe, he had made no stipulation concerning the trifling movables upon its surface. And the earth spins so fast that the surface at its equator is travelling at rather more than a thousands miles an hour, and in these latitudes at more than half that pace. So that the village, and Mr. Maydig, and Mr. Fotheringay, and everybody and everything had been jerked violently forward at about nine miles per second—that is to say, much more violently than if they had been fired out of a cannon. And every human being, every living creature, every house, and every tree—all the world as we know it—had been so jerked and smashed and utterly destroyed. That was all.

These things Mr. Fotheringay did not, of course, fully appreciate. But he perceived that his miracle had miscarried, and with that a great disgust of miracles came upon him. He was in darkness now, for the clouds had swept together and blotted out his momentary glimpse of the moon, and

the air was full of fitful struggling tortured wraiths of hail. A great roaring of wind and waters filled the earth and sky, and, peering under his hand through the dust and sleet to windward, he saw by the play of the lightnings a vast wall of water pouring towards him.

"Maydig !" screamed Mr. Fotheringay's feeble voice aimed at the elemental uproar. "Here !—Maydig :"

"Stop !" cried Mr. Fotheringay to the advancing water. "Oh, for goodness' sake, stop !"

"Just a moment," said Mr. Fotheringay to the lightnings and thunder. "Stop just a moment while I collect my thoughts......... And now what shall I do ?" he said. "What *shall* I do ; Lord ! I wish Maydig was about."

"I know," said Mr. Fotheringay. "And for goodness' sake let's have it right *this* time."

He remained on all fours, leaning against the wind, very intent to have everything right.

"Ah !" he said. "Let nothing what I'm going to order happen until I say 'Off !'... Lord ! I wish I'd thought of that before !"

He lifted his little voice against the whirlwind, shouting louder and louder in the

vain desire to hear himself speak. "Now then !—here goes ! Mind about that what I said just now. In the first place, when all I've got to say is done, let me lose my miraculous power, let my will become just like anybody else's will, and all these dangerous miracles be stopped. I don't like them. I'd rather I didn't work 'em. Ever so much. That's the first thing. And the second is—let me be back just before the miracles begin ; let everything be just as it was before that blessed lamp turned up. It's a big job, but it's the last. Have you got it ? No more miracles, everything as it was—me back in the Long Dragon just before I drank my half-pint. That's it ! Yes."

He dug his fingers into the mould, closed his eyes, and said "Off !"

Everything became perfectly still. He perceived that he was standing erect.

"So *you* say," said a voice.

He opened his eyes. He was in the bar of the Long Dragon, arguing about miracles with Toddy Beamish. He had a vague sense of some great thing forgotten that instantaneously passed. You see, except for the loss of his miraculous powers, everything was back as it had been ; his mind and memory, therefore, were now just as they had

been at the time when this story began. So that he knew absolutely nothing of all that is told here, knows nothing of all that is told here to this day. And among other things of course, he still did not believe in miracles.

"I tell you that miracles, properly speaking, can't, possibly happen," he said, "whatever you like to hold. And I'm prepared to prove it up to the hilt."

"That's what *you* think," said Toddy Beamish, and "Prove it if you can."

"Looky here, Mr. Beamish," said Mr. Fotheringay. "Let us clearly understand what a miracle is. It's something contrariwise to the course of nature done by power of Will..."

THE PEDESTRIAN

Ray Bradbury

To enter out into that silence that was the city at eight o'clock of a misty evening in November, to put your feet upon that buckling concrete walk, to step over grassy seams and make your way, hands in pockets, through the silences, that was what Mr. Leonard Mead most dearly loved to do. He would stand upon the corner of an intersection and peer down long moonlit avenues of side-walk in four directions, deciding which way to go, but it really made no difference ; he was alone in this world of A. D. 2052, or as good as alone, and with a final decision made, a path selected, he would stride off, sending patterns of frosty air before him like the smoke of a cigar.

Sometime he would walk for hours and miles and return only at midnight to his house. And on his way he would see the cottages and homes with dark windows, and it was not unlike walking through a graveyard where only the faintest glimmers of firefly light appeared in flickers behind the windows. Sudden grey phantoms seemed to manifest upon inner room walls where

a curtain was still undrawn against the night, or there were whisperings and murmurs where a window in a tomb-like building was still open.

Mr. Leonard Mead would pause, cock his head, listen, look, and march on, his feet making no noise on the lumpy walk. For long ago he had wisely changed to sneakers when strolling at night, because the dogs in intermittent squads would parallel his journey with barkings if he wore hard heels, and lights might click on and faces appear and an entire street would be startled by the passing of a lone figure, himself, in the early November evening.

On this particular evening he began his journey in a westerly direction, towards the hidden sea. There was a good crystal frost in the air: it cut the nose and made the lungs blaze like a Christmas tree inside; you could feel the cold light going on and off, all the branches filled with invisible snow. He listened to the faint push of his soft shoes through autumn leaves with satisfaction, and whistled a cold quiet whistle between his teeth, occasionally picking up a leaf as he passed, examining its skeletal pattern in the infrequent lamp-lights as he went on, smelling its rusty smell.

'Hello, in there, he wisphered to every house on every side as he moved. What's up to night on Channel 4, Channel 7, Channel 9 ? Where are the cowboys rushing, and do I see the United States Cavalry over the next hill to the rescue ?"

The street was silent and long and empty, with only his shadow moving like the shadow of a hawk in mid-country. If he closed his eyes and stood very still, frozen, he could imagine himself upon the centre of a plain, a wintry, windless Arizona desert with no house in a thousand miles, and only dry river beds, the streets, for company.

'What is it now ?' he asked the houses, noticing his wrist watch. 'Eight-thirty p.m? Time for a dozen assorted murders ? A quiz? A revue ? A comedian falling off the stage ?'

Was that a murmur of laughter from within a moon-white house ? He hesitated but went on when nothing more happened. He stumbled over a particularly uneven section of side-walk. The cement was vanishing under flowers and grass. In ten years of walking by night or day ; for thousands of miles, he had never met another person walking, not one in all that time.

He came to a cloverleaf intersection which stood silent where two main highways cross-

ed the town. During the day it was a thunderous surge of cars, the gas stations open, a great insect rustling and a ceaseless jockeying for position at the scarab-beetles, a faint incense puttering from their exhausts, skimmed homeward to the far directions. But now these highways, too, were like streams in a dry season, all stone and bed and moon radiance.

He turned back on a side street, circling around towards his home. He was within a block of his destination when the lone car turned a corner quite suddenly and flashed a fierce white cone of light upon him. He stood entranced, not unlike a night moth, stunned by the illumination, and then drawn towards it.

A metallic voice called to him :

'Stand still. Stay where you are ! Don't move !'

He halted.

'Put up your hands !'

'But——' he said.

'Your hands up ! Or we'll shoot !'

The police, of course, but what a rare, incredible thing ; in a city of three million, there was only *one* police car left, wasn't that correct ? Even since a year age, 2051 the election year, the force had been cut

down from three cars to one. Crime was ebbing ; there was no need now for the police, have for this one lone car wandering and wandering the empty streets

'Your name ?' said the police car in a metallic whisper. He couldn't see the men in it for the bright light in his eyes.

'Leonard Mead,' he said.

'Speak up !'

'Leonard Mead !'

'Business or profession ?'

'I guess you'd call me a writer.'

'No profession,' said the police car, as if talking to itself. The light held him fixed, like a museum specimen, needle thrust through chest.

'You might say that,' said Mr. Mead. He hadn't written in years. Magazines and books didn't sell any more. Everything went on in the tomb-like houses at night now, he thought, continuing his fancy. The tombs, ill-lit by television light, where the people sat like the dead, the grey or multicoloured lights touching their faces, but never really touching *them*.

'No profession,' said the phonograph voice, hissing. 'What are you doing out ?'

'Walking,' said Leonard Mead.

'Walking !'

'Just walking,' he said simply, but his face felt cold.

'Walking, just walking, walking ?'

'Yes, sir.'

'Walking where ? For what ?'

'Walking for air. Walking to *see*.'

'Your address !'

'Eleven South Saint James Street."

'And there is air in your houses, you have an air *conditioner*. Mr. Mead ?'

'Yes.'

'And you have a viewing screen in your house to see with ?'

'No.'

'No ?' There was a crackling quiet that in itself was an accusation.

'Are you married, Mr. Mead ?'

'No.'

'Not married,' said the police voice behind the fiery beam. The moon was high and clear among the stars and the houses were grey and silent.

'Nobody wanted me,' said Leonard Mead with a smile.

'Don't speak unless you're spoken to !'

Leonard Mead waited in the cold night.

'Just *walking*, Mr. Mead ?'

'Yes.'

'But you haven't explained for what purpose.'

'I explained, for air, and to see, and just to walk.'

'Have you done this often ?'

'Every night for years.'

The police car sat in the centre of the street with its radio throat faintly humming.

'Well, Mr. Mead,' it said.

'Is that all ?' he asked politely.

'Yes,' said the voice. 'Here.' There was a sigh, a pop. The back door of the police car sprang wide. 'Get in.'

'Wait a minute, I haven't done anything!'

'Get in.'

'I protest !'

'Mr. Mead.'

He walked like a man suddenly drunk. As he passed the front window of the car he looked in. As he had expected, there was no one in the front seat, no one in the car at all.

'Get in.'

He put his hand to the door and peered into the back seat, which was a little cell, a little black jail with bars. It smelled of riveted steel. It smelled of harsh antiseptic ; it smelled too clear and hard and metallic. There was nothing soft there.

'Now if you had a wife to give you an alibi,' said the voice. 'But——'

'Where are you taking me?'

The car hesitated, or rather gave a faint whirring click, as if information somewhere, was dripping card by punch-slotted card under electric eyes. 'To the Psychiatric Centre for Research on Regressive Tendencies'.

He got in. The door shut with a soft thud. The police car rolled through the night avenues, flashing its dim lights ahead.

They passed one house on one street a moment later, one house in an entire city of houses that were dark, but this one particular house had all of its electric lights brightly lit, every window a loud yellew illumination, square and warm in the cool darkness.

'That's *my* house,' said Leonard Mead.

No one answered him.

The car moved down the empty river bed streets and off away, leaving the empty streets with the empty side walks, and no sound and no motion all the rest of the chill November night.

NOTES

THE METHOD OF SCIENTIFIC INVESTIGATION

Thomas Henry Huxley (1825—1895), scientist and philosopher influenced English thought by many addresses and publications on philosophical and religious subjects. He coined the word 'Agnostic' to express his own philosophical attitude. 'Agnostic' is one who holds that we know nothing of things beyond material phenomena—that a First Cause and an unseen world are things unknown and apparently unknowable In this essay he explains briefly the methods of reasoning, induction and deduction on which scientific investigation is based. This information should prove very useful to the student of science who has begun a serious study of scientific laws.

Moliere, the name assumed by the French comic dramatist Jean Baptiste Poquelin (1622—73).

Newton, Sir Isaac (1642—1727), a great philosopher and scientist, a pioneer on theory of gravitation. The poet Wordsworth wrote the glorious lines on him:

"The marble index of a mind for ever
Voyaging through strange seas of thought alone."

Fallacy : an apparently genuine but really illogical argument. For a humorous illustration of the idea of fallacy see the story in this book, *Logic—Love a fallacy*.

GALILEO AND SCIENITIFIC METHOD

Bertrand Russell, Bertrand Arthur Wiliam, third Earl Russell (1872—1970) one of the most brilliant minds of modern times, who has written extensively

on philosophy, logic, education, economics and politics.

Freud, Sigmund (1856—1939), the inventor of psycho-analysis.

Sadism—a form of sexual perversion marked by a love of cruelty. The word is derived from the French, licentious writer count Marqius de Sade (1740—1814).

Copernican theory—The Theory of the celebrated astronomer Copernicus (1473—1543) that the planets including the earth move in orbits round the sun as centre, in opposition to the older theory of Ptolemy that the sun and planets move round the earth.

Archimedes (287—212 B.C.) a famous mathematician of Syracuse.

Aris'archies, an eminant astronomer and mathematician who lived about 280 B.C. He maintained that the earth revolved round the sun and that this was the cause of the seasons.

Leonardo da Vinci (1452—1519), Florentine painter, sculptor and engineer.

Plutarch—the biographer and moral philosopher, who lived about A.D. 66.

Roger Bacon (1214—94), the founder of English philosophy. He advocated the substitution of an appeal to experience for the scholastic method of argument from general premises based on authority.

Montaigne, French philosopher and essayist (1533—92). The general conclusion of his essays is the recognition of the falibility of human reason and the relativity of human science.

Rabelais, Francois (1494—1553), French humanist, satirist and physician, author of 'Gargantua' and 'Pantagruel.

Gamin, (French), a precocious and mischievous imp of the pavement.

Einstein, Albert (1879—1955), the famous author of the General Theory Relativity.

Eppur Si Muove—,'but it does move.'

THE SCIENTIST AS AN ARTIST

George Russell Harrison is an American writer. The essay is taken out of the *Technology Review* of the Massachusetts Institute of Technology.

Boris Pasternak (1890—1960), Russian author of the famous novel *Dr. Zhivago* (1958).

Beethoven, Ludwig Van (1770—1827), the famous German composer, who perfected the symphony.

Praxiteles, 4th century B C. Greek Sculptor.

Maxwell, James Clerk (1831—70) first professor of experimental physics at Cambridge, contributed to the development of the Theory of the Conservation of Energy.

Rutherford, Earnest (1871—1937), a great experimental physicist.

Kepler, Johaann (1571—1630) a celebrated German astronomer.

Bohr, Niels (1886—1962), Danish Theoretical physicist.

Keats, John (1795—1821), English romantic poet : The line quoted is out of Keat's famous Sonnet, "On first looking into Chapman's Homer."

Magellan, an English form of the name of the Portuguese navigator Fernao de Magalhaes (1472—1521), the first European to pass through the straits that bear his name.

Kipling, Rudyard (1865—1936), poet and novelist, who worked as a journalist in India.

Malraux, Andre (1901—), French novelist, essayist and art-historian.

SPECIALISATION IN EDUCATION

Sir Richard Livingstone, classicist, at one time Vice-Chancellor of Oxford University distinguished for his understanding of the classical mind and his stalwart defence of humanistic studies as a preparation for useful modern life. He is the author of *Greek Ideals and Modern Life, The Future in Education, Education for a world Adrift* and *Some Tasks for Education*. The present essay is the substance of an address delivered at the Massachusetts Institute of Technology in 1950 at "The Mid-Century Convocation on the Social Implications of Scientific Progress."

The scientist in the 20th Century is thought of by some people as a half-educated menace, who learns more and more about less and less. It is charged that he is not educated, since he is usually ignorant of every thing not pertaining to his speciality and does not have a sense of values based on broad knowledge and understanding. He is atonce learned and ignorant: Ortega G. Gasset, a spanish educationist calls him a 'learned ignoramus' incapable of contributing to the synthesis of knowledge essential to the progress of civilization.

Sir Richard discusses both the advantages and disadvantages of specialization and finally stresses in the wise words of Plato, the importance of "the knowledge of good and evil."

Lord Hailey: A member of the old I. C. S., one time Governor of the Punjab, author of the *Britain and Her Dependencies*, and the *Future of Colonial Peoples* (1944).

Plato: (C. 427-348 B. C.) the Great Greek Philosopher, a pupil of Socrates, author of *heory of Ideas and Dialogues etc.* The quotation given by Sir Richard is out of Plato, *Charmides* C 174, b. and c.

THE DYING SUN

Sir James Jeans, F.R.S. (1877—1946) astronomer and writer on cosmogony 'Theory of the creation of the Universe) and stellar physics. *The Dying Sun* is the first chapter of his popular book *The Mysterious Universe*, which appeared in 1930, and is a sequel to his earlier book *The Universe around us*. Sir James possesses the gift of writing good scientific prose, clear logical but occasionally interspersed with an imaginative phrase. The chapter included in this book gives only a partial idea of Sir James Jean's theory of the creation of the Universe and the impression given of the "accidental" creation of the Universe is modified in later chapters. In fact his view of the Universe is not at all "Mechanical." He says in the last chapter—"The Universe begins to look more like a great thought than like a great machine"; further on he says—"if all this is so, then the Universe can be best pictured, although still very imperfectly and inadequately as consisting of pure...thought, the thought of what, for want of a wider word, we must describe as a mathematical thinker." He quotes approvingly, Bishop Berkeley's words that the Universe subsists "in the mind of some Eternal Spirit." That is why they say

that in the 20th Century, modern science, particularly physics, and religion are coming together.

Strum: Touch notes or twang strings of piano or other stringed instruments, especially and unskilfully.

Tantalus in Greek mythology the father of Pelops and Niobe. He is represented as punished in hell with an intense thirst and placed up to the chin in a pool of water which recedes when he attempts to drink it.

WHAT LIFE HAS TOUGHT ME

Bertrand Russell (1872—1970), a brilliant and prolific writer in the field of mathematics, relativity, philosophy, morals, science and fiction, a man who has been described as being incapable of being dull as he is of being shallow The present essay was written for an anthology of the same name published in 1948, to which outstanding modern personalities in various spheres of life contributed. The essays contains profound reflections on themes of contemporary significance by a brilliant critic and may be found instructive by young people.

Bradlaugh, Charles (1833—1891) famous as an advocate of free thought

Dreyfus, Alfred (1899—1935) an officer in the French Army, famous owing to the judicial miscarriage which caused his imprisonment and the fierce controversy which preceded his rehabilitation. In the course of this controversy Emile Zola published his famous letter *J'accuse* and was condemned in consequence to a year's imprisonment

Obscurantism:—Opposition to the progress of knowledge and enlightenment. What Russell says on this

subject and that of nationalism has aptness for us in Pakistan.

Causes Belli :--That which involves or justifies war: occasion or ground for quarrel.

EDUCATION AND THE TRAINNG OF CHARACTFR

See the note on the same author under *Specialization in Education*, The present essay is taken frcm his book *Education for a world Adrift* (1943). This essay should help the science students to acquire a broader view of ednction. Scientific training may help the pupils to acquire vocational and professional competence but what Livingstone calls social and spiritual education may possibly be neglected. Culture and civilization of a society depend, in his words, on "its standards, its sense of values, its idea of what is first rate and what is not." He emphasizes "the need for vision"—"Moral education is impossible without the habitual vision of greatness" We must know what is first rate, in science as well as in social and moral fields. This essay must be read in cojunction with Livingstone's other essay *Socialisation in Education* so that a balanced view of science and technology may be acquired.

Whitehead, Professor A. N. Whitehead (1861—1947). Professor of Applied Mathematics in the Imperial College of Science and Technology, London, and Professor of Philosophy at Harvard University, U.S.A., author of many remarkable books like *Science and the Modern World* and *The Aims of Education*. The quotation is taken out of the latter book.

HOW TO WRITE AND HOW TO WRITE BADLY

C. E. M. Joad, English philosopher who has helped to popularize (in the good sense of the word) philosophy. Like Aldous Huxley, he has written many types of essays which are explorations of a quiet and many-sided man into many realms of experience. The present two essays are out of his work *"The Bookmark"* and were originally contributed to a socialist weekly paper.

These essays should interest the science student who wish to acquire a lucid and natural style of putting their thought in to words—avoiding jargon and journalese. "Observe accurately. think clearly, choose the right words .... be as fresh, brief and original as you can—and above all, do not be afraid of being natural"—this is excellent advice to students as well as teachers of all subjects, including the sciences.

Herculean : Pertaining to Hercules : extremely difficult and laborious like the twelve labours of the Greek hero Hercules.

Gregory Powder :—Compound Powder of rhubarb, named after the Scottish physician James Gregory (1758—1822).

Highfalutin bunkum (slang) empty, bombastic, pompous writing.

Grimalkin : old she-cat

Oscar Wilde (1856—1900) He was one of the most elegant writers of the late 19th century and was one of the foremost exponents of the doctrine of Art for Art's sake, arguing that aesthetic considerations should be given first place in literature

Samuel Butler (1835—1902) : author of *Erewhon*, one of the greatest English prose satirists, who exposed shams, and hypocrisies of all **kinds with**

honesty and biting wit. His *Notebooks* were published posthumously in 1912.

Newman. John Henry (1801—90): a Cardinal in the Roman Catholic Church. He wrote verse and prose and was master of a distinctive and flowing literary style.

Stevenson. Robert Louis (1850—94): Novelist and poet; his style was easy and graceful, the result of much care and close attention to artistic finish.

How to Wrtte Well

See the note on the previous essay.

Platitudinous, from platitude, a flat empty remark made as if it was important.

Meredith, George (1828—1909) English novelist and poet, author of the *Adventures of Henry Richmond, The Egoist etc.*

Rotfer: a microscopic animal with rotary organ used in swimming

Dr. Johnson, Samuel (1709—1784), poet and essayist noted for his *Dictionary* (1747—55). In the early work his prose was heavy, rhetorical in structure and full of affectation; in his *Lives of the Poets*, however, his prose has the ease, lucidity, force and vigour of his conversation, as recorded by Boswell.

Hazlitt, William (1778—1830): essayist, literary critic. Expressed his opinions honestly and fearlessly. He wrote brief, abrupt sentences fitting his vigour and directness of his views. His diction is pure, his expression concise.

Perspicuity Clearness in expressing ideas so as to make them easily understood by others.

Pocock. George: author of *Pen* and *Ink*

Come away...etc; a song from Shakespeare's *Twelfth Night II iv.*

Joseph Conrad (1827—1924), Polish author whose prose is almost like poetry. Author of *Typhoon, The Nigger of the Narcissus, Lord Jim* etc.

Hudson, William Henry (1841—1922), naturalist and writer. The simplicity and directness of his charming style are the result of careful artistry.

LOGIC—LOVE IS A FALLACY

This story is taken from Max Shulman's book *Many Loves of Dobies Gillis* (1951). It is a light hearted humorous story, showing how the exercise of logic proves love to be a fallacy—an apparently genuine but really illogical argument. It is written in a colloquial style, sometimes degenerating into slang.

Raccoon—a genus of the bear family of North America, valuable for its fur.

Going Steady—an American phrase of courtship when the boy and girl go out on 'dates' steadily with a view to marriage.

THE MAN IN ASBESTOS: AN ALLEGORY OF THE FUTURE

Leacock, Stephen Butler (1869—1944), political economist but better known as a writer of humorous stories. The present story is taken from his collection *Nonsense Novels* (1921).

Like the subsequent story, *The Pedestrian*, this story is "an allegory of the Future," a vision of the millenium. In both stories the authors describe a 'Wasteland' created by an over-technological society and express a nostalgia for the simpler, more natural

society of the past. While in the *Pedestrian* the moral is implied, in this story it is put in so many words: "Is this then your coming civilization, your millennium. This dull, dead thing with the work and the burden gone out of life and with them all the joy and the sweetness of it! For the old struggle—mere stagnation and in place of danger of death, the dull monotony of security and the horror of an unending decay. Give me back...the old life of danger and and stress, with its hard toil and its bitter chances and its heart-breaks."

Thus science and technology prove to be a double edged weapon and both these stories are pleas for humanism.

THE MAN WHO WORKED MIRACLES

H. G. Wells (1866—1946) novelist and short story writer—a poineer writer of scientific romances. Also a sociological novelist with the zeal of a reformer and the manner of a satirist whose irony does not gall. The present story is taken from *Tales of Space and Time*, published in 1897. It is an early example of Wells' scientifi-cum-romantic imagination toying with the possibility of a 'wilful' interference in the course of nture. J. J. Ratcliff, in a catalogue of some prominent characteristics of Wells' stories includes—"a background of scientific fact and theory, with a continual delight in showing how extraordinary things might happen with a slight preliminary departure from the normal; the character of a very ordinary or dull fellow giving the reader writer's point of view, a well-made and consistent plot with a marked climax, a genial often part, play of humour, at times irony,

at times facetious wit." Some of these characteristics are reflected in the present story.

Poutoum (French). a short Malayan poem of four-lined rhyming stanza—the 2nd and 4th lines of each stanza being repeated as the 1st and third of the next and the 1st and 3rd lines of the first repeated as the 2nd and 4th of the last.

annhauser, a German lyrical poet of the 13th century, the subject of a legend according to which, was attracted by Venus, and spent seven years with her in revelry. Smitten by his conscience he left her and went to the Pope to seek absolution. The Pope said that it was impossible for Tannhäuser to be forgiven as for his dry staff to burgeon and grow branches. Tannhauser departed in despair. But after three days the staff broke into blossom.

Hades in Greek Mythology the name of Pluto's hell, a gloomy sunless abode where according to Homer, the ghosts of the dead fiit about like bats.

Post prandial, after dinner, when a person is genial and relaxed.

haumaturgy—the working of miracles.

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THE PEDESTRIAN

Ray Bradbury (1920 -) an American writer, is recognized as one of the leading writers of what is called, "Science Fiction." It is said that an S F. (Science Fiction) story is one "which presupposes a technology, or a disturbance in the natural order, such as humanity, upon the time of writing, has not in actual fact experienced." H. G. Wells story "*the an How Worked iracles*" is one early instance of

it and "The Pedestrian" is even a better example. The author is deeply concerned with the effect of a technological revolution in human society. The world of A. D. 2052 in which Leonard Mead is condemned to live has lost all human attributes. Men and women are reduced to passive automations who live alone in the silence and darkness of their tomb-like houses. surrounded by by technical gadgets like television, which act as an anodyne. There is no conversation, no human contact. Leonard Mead, who is an old fashioned human likes "walking for air and to see and just to walk." This is an offence and he is arrested by an unmanned, metallic automobile and sent presumably for brainwashing "To the Psychiatric Centre for Research on Regressive Tendencies"

Long ago H. G. Wells described man as "a monkey in a moving motor car" - a car that the monkey had built and set in motion but did not know how to steer. Bradbury and authors like Aldous Huxley (*Brave New World*) and George Orwell *Nineteen Eighty four* have imagined technological Utopias which depict man dehumanized by technology and totalitarianism and a captive of his own Frankenstein inventions. These writers survey with pity the possible destiny of *homo sapiens* and with little explicit moralising, sound a warning - 'What shall it profit a man . . . '

The story is taken from Bradbury's book "*The Golden Apples of the Sun.*" Critics have remarked about 'the gleams of poetry" that shine through Bradbury's prose.

THE END

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